FINAL REPORT of the AMC COMMITTEE-ARMAMENT

ARMAMENT DEVELOPMENT CENTER CONCEPT PLAN

VOLUME 2 of 4 VOLUMES
December 1974

APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

DISCLAIMER

This report is the product of the Army Materiel Command Committee-Armament, an ad hoc committee formed by the Commander, US Army Materiel Command. It responds to a Department of the Army requirement to study the recommendation of the Army Materiel Acquisition Review Committee (AMARC) regarding establishment of an Armament Development Center. It presents alternative concepts, not detailed plans. It is advisory in nature and reflects neither official policy nor approved plans of the Department of the Army. The Secretary of the Army has directed that it be released to interested Members of Congress for their review and comment.

VOLUME 2

TABLE OF CONTENTS

ARMAMENT DEVELOPMENT CENTER STUDY AND CONCEPT PLAN

PREFACE

1. Introduction. This study is the product of an extensive effort to develop a concept plan for the creation of an Armament Development Center (ADC). Creation of an ADC was one of the principal recommendations made by the Army Materiel Acquisition Review Committee (AMARC), a group assembled by the Secretary of the Army to review the acquisition process.

2. Purpose. AMARC recommended that within AMC, management of new weapon systems and major product improvements should be separated from management of logistics functions. More specifically, that committee's report recommended creation of an "Armament Development Center at a single location, through an evolutionary process, by consolidating selected elements of Frankford, Picatinny, Rock Island, and Watervliet Arsenal RD&E activities together with the Ballistic Research Laboratory and portions of the ARMCOM RD&E Directorate."[1/] AMARC listed the following advantages to be achieved ultimately by this consolidation:

> "(1) More effective 'critical mass' of technical talent, expediting consultation, broadening career opportunities and facilitating civilian personnel management.
>
> (2) Large demanding missions challenging the work force, providing them a sense of valuable contribution, stabilizing installation funding fluctuations, and minimizing invention of insignificant 'job security' efforts.
>
> (3) More effective equipment being fielded at less overall cost resulting from reduced in-house manpower, closer coordination of subsystem developments, savings in travel expenditures, and more efficient transfer of systems technology to industry.
>
> (4) Substantially faster response to intensified needs or critical problem areas due to greater flexibility of scientific and engineering resources.

1/ Report of the AMARC, Vol II, 1 Apr 74, Para 4a, Page VI-21

(5) Expanding opportunities for innovative and creative ideas to surface for potential military application.

(6) More realistic estimating of program options, risks, performance, and schedules by more effective coupling of internal expertise to the acquisition process.

(7) Reduction in overhead costs resulting from shared and more fully utilized support activities, such as security, safety, quality assurance, drafting, and machine shops."

3. Assumptions:

a. Initial Assumptions. On 28 May 1974, Headquarters, AMC issued a letter (Annex A) directing that this study be made and providing guidance which included the following assumptions:

Create an organizationally separate development center.

The development center will be responsible for the development of a system and for its acquisition until it has been fielded. After a system has been fielded, the center will continue to provide technical and Technical Data Package (TDP) support to the Armament Command.

b. Additional Assumptions. The following assumptions have been added in developing a concept plan for the Armament Development Center:

The development center will require significantly fewer personnel than the RD&E elements now in the armament community.

The recommended site for the center need not necessarily be an AMC or Department of the Army installation.

4. Logistics. AMARC made a corollary recommendation on creation of centers which would be responsible for the logistics functions. Volume 4 of the present study examines the concept of an Armament Logistics Command (ALC) which would be the counterpart to the ADC.

5. Study Plan. The size, complexity, and importance of the armament community dictated the need for a comprehensive concept plan supported by an in-depth study to organize, populate and site the proposed ADC. In the process, this study would also test the

feasibility of the plan. The study effort placed emphasis on the following areas:

a. The Current Organization. Gathering and analyzing statistical and verbal information needed for a comprehensive study and detailed description of the organizations currently performing the armament development and readiness functions; studying the effects which proposed changes will have on the existing structures and operations, with particular attention to insuring that the readiness function is not adversely affected.

b. Concepts for an ADC. Developing alternative concepts for an Armament Development Center, taking a broad approach and making extensive use of consultants and visits; defining early the purpose and functions of such a center; developing organizational patterns which will provide close ties to the users, will be output oriented, and will foster scientifically based innovation in both research and application.

c. Sites and Resources. Developing criteria for site selection, giving consideration to current AMC facilities, to other DOD sites which may become available, and to locations not now under DOD control; analyzing data developed and visiting prospective sites; determining the cost and other impacts associated with locating proposed organizational alternatives at selected candidate sites.

d. Economic Analysis. Preparing a sound economic analysis and examination of economic and other impacts to provide comparisons of all relevant aspects of the alternatives and facilitate the selection of the best alternative; insuring that the analysis meets the rigorous standards of the anticipated audiences; making comparative evaluations of economic and other impacts, particularly on affected local communities.

e. Concept for an ALC. Examining the logistics residual to insure the viability of the total armament community; developing a concept plan for the establishment of an ALC to include missions, functions, concept of operations, outline of organization, relationships and key interfaces with the ADC and others, adjustments in key areas (facilities, personnel, and budgets), closures, consolidations, reductions, realignments, estimates of costs and savings, and a phased implementation plan.

6. Organization. The Chairman organized his committee along these lines of emphasis, employing as many as 25 full-time professionals at the height of the study effort (Annex B). Assisting and broadening this effort were a second group of individuals from within the Army's armament community and a third group of recognized experts from outside the Army who worked particularly on concepts for an ADC.

They are listed in Annex II-A. Individuals were selected on the basis of their knowledge and experience in armament matters or in the management of large research and development activities. Two of the consultants are from research and development activities and served on the Science and Technology Team of the AMARC, the element that recommended creation of the development center; two are from industry; and one is from the Office of the Director of Defense Research and Engineering. One of the industry members also serves on the Army Scientific Advisory Panel.

7. Assessment. The views of these and many others, including arsenal employees visited at their work and community representatives, were given careful consideration. The opinions reflected throughout the study and the final evaluation represent the best judgement of the study committee which for seven months gathered and weighed this comprehensive collection of data and expert opinion.

CHAPTER I

CURRENT ARMAMENT COMMUNITY

CHAPTER I

CURRENT ARMAMENT COMMUNITY

CHAPTER I

CURRENT ARMAMENT COMMUNITY

SECTION A: Introduction.

1. Purpose. The purpose of this chapter is to describe the present system for acquiring armaments as a basis for evaluating the merits of the AMARC recommendation and as a first step in "evolving" an Armament Development Center (ADC) from elements of this system. Strengths and weaknesses of the current system derived from the study are included in the discussion as appropriate.

2. "Armament Community" - Definition. In this study it has been assumed (as apparently AMARC assumed) that the ADC will be responsible for the development of armaments currently assigned to the Armament Command (ARMCOM); the portion of ARMCOM Regulation 10-1 that depicts ARMCOM's mission and major functions is shown in Annex I-A. The "armament community" is assumed to include ARMCOM, the ARMCOM Project Managers, plus the Ballistic Research Laboratories (BRL). Activities such as the Army Research Office, the Human Engineering Laboratory, the Foreign Science and Technology Center, and others, that influence the development of armaments were not considered for inclusion in an ADC at this time and hence, were not studied in detail. The Harry Diamond Laboratories (HDL) elements devoted to armaments and the Project Manager for Munitions Production Base Modernization and expansion were initially considered as part of the ADC base line, but are excluded from this report since HDL in its entirety is to be a part of a separate development center; the project manager will continue to report directly to AMC. Also excluded were the supply and storage (Depot) activities supporting armaments.

3. Data Base Line. a. Source. Data covering organization, personnel, operating relationships, program and budget, facilities, and equipment for the base line year of FY 74 were requested from each organization within the community. Visits were made to each major installation to discuss the data and to gain a first hand view of the operation and physical plant. Visits were also made to several Army ammunition plants and to private corporations that manufacture fuzes and projectile metal parts. A complete listing of visits and dates is shown in Annex I-B.

b. Validity. Funding, personnel, and facilities data received from the armament community were analyzed, evaluated and checked against other sources to ensure credibility. Within the accuracies permitted by normal accounting procedures, double-counting of funding, due to flow within and outside the community, was eliminated. Understandably, installations engaged in both development and logistics activities had difficulty in estimating equivalent man years spent in

each activity and in apportioning the use of facilities and equipment between activities. Estimated breakouts of activities funded by PEMA and OMA accounts, equivalent man years of effort, and facilities and equipment utilization were based on the concept of ADC activities and the judgement of experienced personnel.

4. Perspective. This description of the current armament system shows that it is, by its very nature, a large and complex business. Analysis shows, however, that even though the magnitude of the task to be accomplished cannot be changed, proper restructuring of the current operating organizations and their budgeting hierarchies offers potential for producing results in a more efficient, effective and economical way. Viewed in historical perspective, the evolution of the armament system to its present posture appears both reasonable and understandable. However, the good reasons which justified each evolutionary step no longer applies. Certainly, no one starting with a clean slate would set up the armament community in its present configuration. Development and logistics functions are subdivided and dispersed in a manner, and to a degree, that now inhibit rather than facilitate mission accomplishment. Urgent and high priority logistics or readiness requirements compete for RDTE resources with the less time-sensitive requirements of development programs, to the detriment of the latter. At times, the management structure even appears to work at cross purposes with mission accomplishment. More and more, the important tasks are assigned to program, project, or team chiefs are formally authorized to cut across formal management and budgetary boundaries to get the job done. In smaller matters, similar lines of communication have sprung up informally around and across the formal lattice work as a necessary means for doing business. This seems to call for a reorganization which eliminates old barriers; provides fewer and simpler interfaces; and both recognizes and accommodates the most effective types of program and project management which have evolved.

SECTION B: Description.

1. Purpose. This section provides a brief overview of the entire armament community highlighting elements generally associated with development center activities.

2. Composition and Locations. As stated, the current armament community is comprised of ARMCOM and the BRL; the former is a major subordinate command of the AMC, and the latter a separate Class II Activity of the AMC. The Armament Command consists of HQ ARMCOM; seven government-owned, government-operated (GOGO) arsenals; one program and four project managers; and 26 government-owned contractor-operated (GOCO) ammunition plants. The command has 40 government-owned subordinate units. Names and locations of the primary arsenals with collocated Project/Program Managers are shown in Figure I-1. Locations of ARMCOM installations and the BRL are shown in Figure I-2.

Arsenal	Collocated PM
Rock Island Arsenal (RIA) Rock Island, Illinois	Cannon Artillery Weapon Systems (CAWS) Vehicle Rapid Fire Weapon System (VRFWS)
Picatinny Arsenal (PA) Dover, New Jersey	Safeguard Munitions (SAF) Selected Ammunition (SA)
Edgewood Arsenal (EA) Aberdeen Proving Ground, Maryland	Chemical Demilitarization (DEMIL)
Watervliet Arsenal (WA) Watervliet, New York	None
Frankford Arsenal (FA) Philadelphia, Pennsylvania	None

Figure I-1

CURRENT ARMAMENT COMMUNITY

INSTALLATIONS AND ACTIVITIES

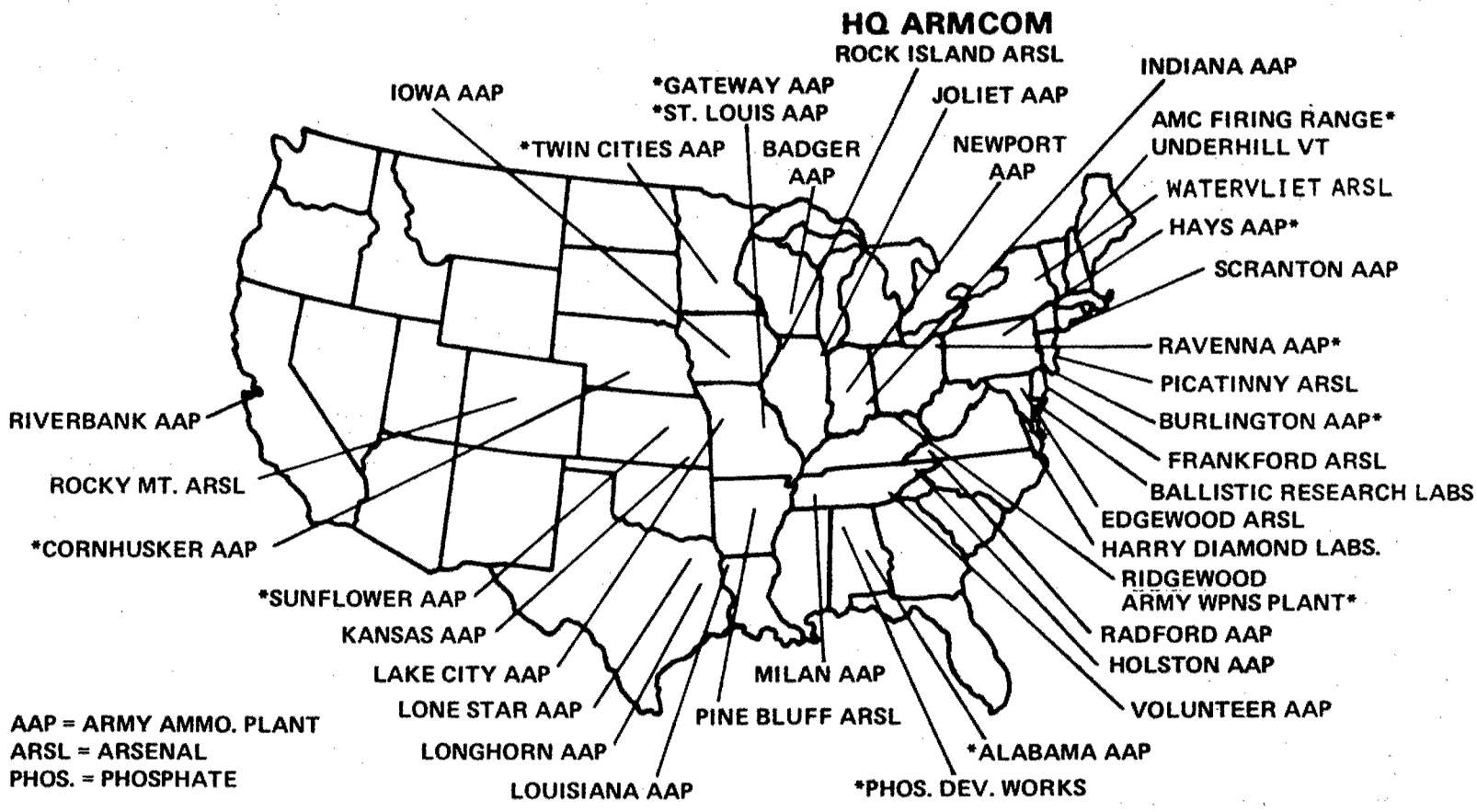


Figure I-2

3. Organization. a. Formal. The ARMCOM organization follows the AMC standard as shown in Figure I-3. In all staff directorates of the HQ, support is provided to both logistic and development functions. In many cases there are no clear lines between these functions.

(1) Development. For development activities, the command line is from the ARMCOM Commander to the arsenal commander, to the performing RDTE element of the arsenal. The arsenal commander and his subordinate directors of RDTE have responsibilities for both development and logistics. Most of the managers who can devote full time and attention to development are, at best, at the fourth level down within the organizational structure, e.g., the system engineering manager for the 8-inch munitions family must work through a Director of Development, an Arsenal Commander, and the Director of Research, Development and Engineering before reaching the individual responsible for life cycle management -- the CG, ARMCOM. Within the arsenal, the development effort is supported by the production capabilities and by the staff. In turn, the development effort supports production. The ARMCOM PM's and the PM for Base Modernization deal directly with the arsenals. Non-ARMCOM project managers usually work through the ARMCOM staff. The ARMCOM Director of RD&E coordinates activities for the commander and provides the CG information which he uses as the basis for exercising control. ARMCOM (and MICOM) tasks HDL in 6.3b and 6.4 fuze programs and provides funds and program direction. ARMCOM similarly controls some of the effort at BRL. ARMCOM does not currently control all activities that might be assigned a development center. For example, a major portion of the fuze technology work at HDL is guided and funded by AMC. The ballistic and vulnerability technology base at BRL and the weapons systems analysis work at AMSAA are similarly treated.

(2) Logistics. Supply, maintenance, production, and related procurement activities are at the heart of the logistics mission. These activities include inventory management of end items and repair parts, production and procurement to maintain the desired stockage level, and scheduling of rebuild, overhaul, and modification. The key elements are the National Inventory Control Point (NICP), the National Maintenance Point (NMP), the Procurement and Production elements of ARMCOM Headquarters, the producing arsenals (Watervliet and Rock Island) and the GOCO ammunition plants. These elements interface closely throughout all phases of the life cycle with the elements performing development activities. Figure I-4 shows the relationship of subordinate and non-subordinate activities with ARMCOM Headquarters.

b. Informal. Although it does not show on the formal organization, the Commander ARMCOM has designated his Deputy Commander as Deputy for Logistics with NICP and NMP responsibilities and his Director of Procurement and Production as Deputy for Procurement with responsibility for procurement, production and plant operations. The Commander has

HEADQUARTERS, UNITED STATES ARMY ARMAMENT COMMAND

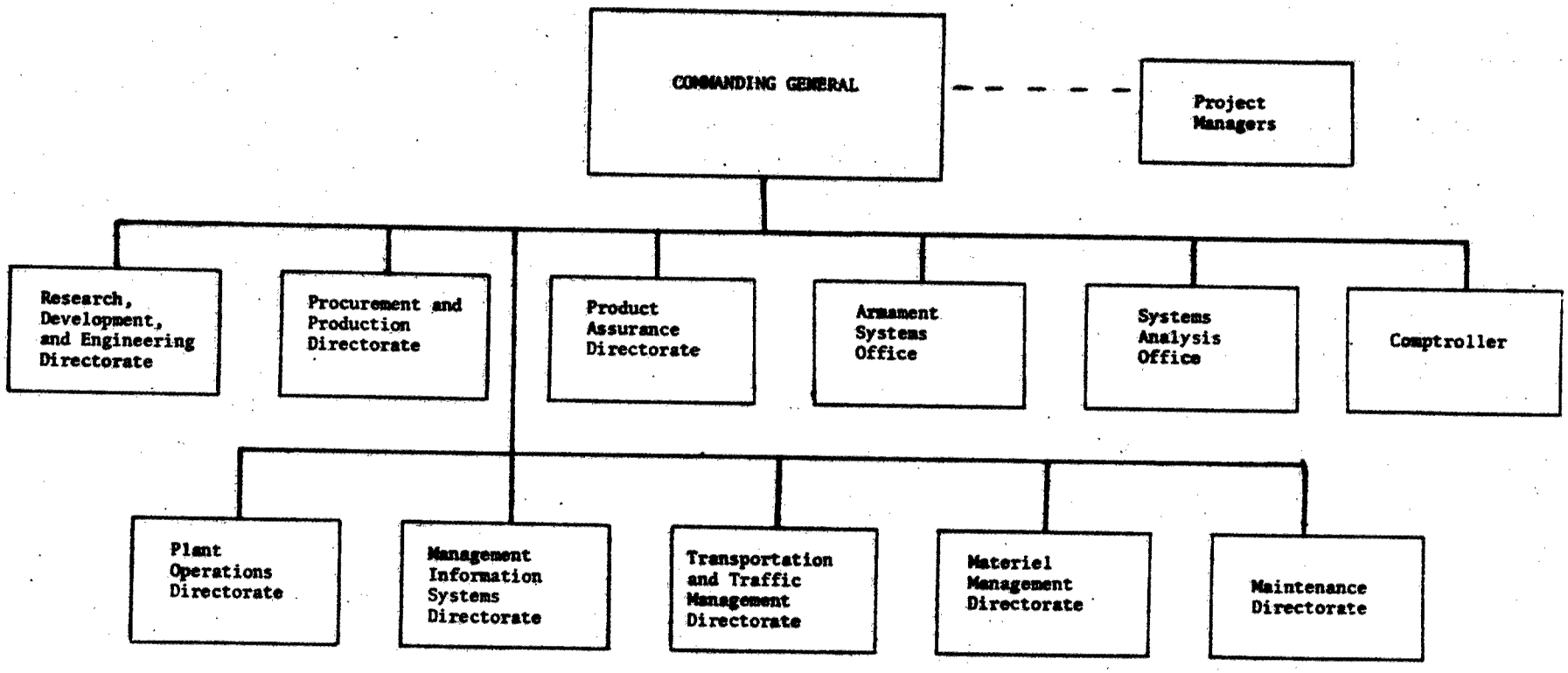
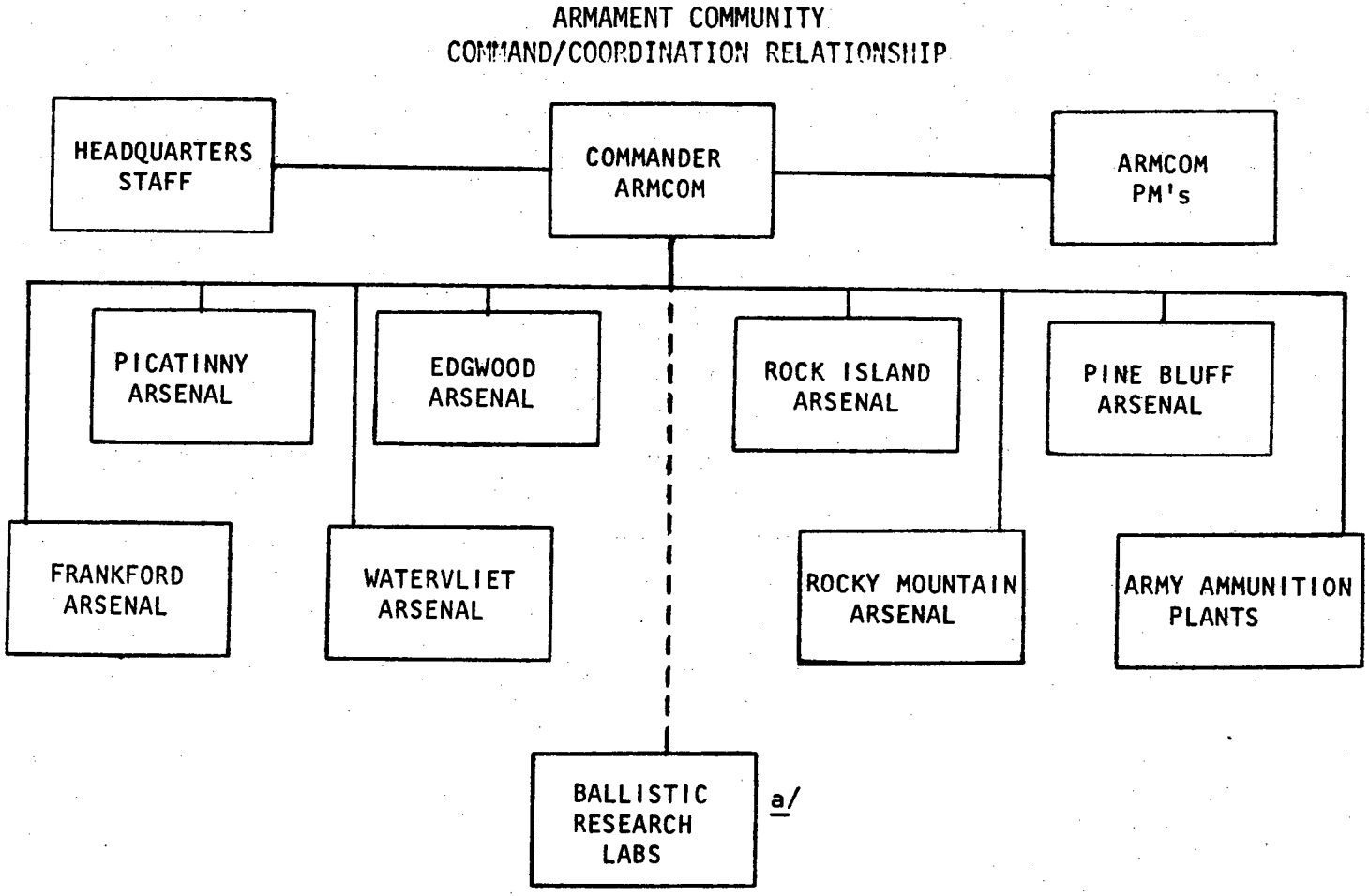


Figure I-3



a/ Reports directly to Headquarters, AMC

Figure I-4

retained RDTE as his own responsibility. There is a continuous flow of information on progress and problems on an informal basis between project engineers and staff elements. This same informal interchange takes place with BRL and with staff elements of AMC and DA. Generally formal actions confirm actions coordinated earlier, informally. This informal organization, approximates in some ways a matrix type of management and helps offset the fragmentation in the formal structure.

c. Arsenal Organization [a/]. How ARMCOM subordinate elements are organized and how they operate depends on whether they were formerly parts of the US Army Weapons Command (WECOM) or the US Army Munitions Command (MUCOM). At Rock Island and Watervliet, the former WECOM Arsenals, all RDTE functions are concentrated in a "laboratory" (Rodman Laboratory at RIA and Benet Laboratory at WA). These laboratories are semi-autonomous under the Arsenal Commander; each has the necessary mix of skills to perform nearly all RDTE functions with relatively little support required from other arsenal directorates. One exception is the absence of a maintenance engineering mission from Rodman. In contrast the former MUCOM Arsenals -- Picatinny, Frankford and Edgewood -- have "laboratories" that work primarily on basic and applied research. Concepts and effectiveness studies, systems engineering design and production and maintenance engineering functions are performed in an engineering development directorate. Support, such as drafting, telemetry, instrumentation, and testing is, provided by a technical support directorate; quality engineering support by a product assurance directorate; and prototype fabrication and limited production by an industrial operations directorate.

d. "Arsenal System". Seven of the eight arsenals in AMC are within the armament community; the one exception, Redstone Arsenal, is the home of the US Army Missile Command. Of the seven, Pine Bluff Arsenal is engaged in manufacture and storage of chemical munitions. Rocky Mountain is engaged in demilitarization of chemical munitions, with a stand-by capability for chemical agents manufacture. Neither would be assigned to a development center. All of the remaining five arsenals were at one time manufacturing facilities with an in-house engineering capability to support production. All retain a production capability. Research, development and engineering support missions have been assigned either to provide a technology base for the type items being produced or to take advantage of the resident expertise. Only two arsenals - Watervliet and Rock Island - are now manufacturing items; and, in most cases, quantities are low. Picatinny,

---

a/ Abbreviations used in this study for ARMCOM Arsenals are as follows: Frankford Arsenal (FA), Rock Island Arsenal (RIA), Picatinny Arsenal (PA), Watervliet Arsenal (WA), Edgewood Arsenal (EA), Pine Bluff Arsenal (PBA) and Rocky Mountain Arsenal (RMA). APG is the abbreviation for Aberdeen Proving Ground.

Frankford, and Edgewood would be better titled development and engineering centers. Presently, their production capability supports development activities including pilot production of test quantities, and in some few cases, the first production run to validate the TDP. On occasion they have produced low order quantities where a suitable commercial source was not available and emergency orders for items not in production. During Korea and Vietnam, this capability was used to fill the gap until private industry could meet the need.

4. Mission. A summary statement of the mission of the Armament Command is: perform integrated commodity management of armament systems, including artillery weapons, individual and crew served weapons, and aircraft weapons systems, fire control (excluding missile system and air defense fire control coordination systems); nuclear and non-nuclear ammunition; rocket and missile warhead sections; demolition and munitions, mines, bombs, grenades, pyrotechnics, boosters, JATOs and gas generators; defensive chemical and biological material; flame, incendiary and riot control munitions; explosive ordnance disposal (EOD) and technical escort (TE) procedures and equipment; radiological material; propellant actuated devices; common-type tools and common-type tool and shop sets (excluding DSA and GSA items); test equipment that is a part of or used with assigned materiel; and perform basic and applied research concerning assigned materiel development.

a. Functional Responsibilities. AMARC recommended the separation of the life cycle functional responsibilities for armaments into two broad areas; "development" and "logistics" (or readiness). Further examination suggests that the "logistics" portion of the life cycle can be further subdivided into two major areas; production base and logistics support. Shown in Figure I-5 are summaries of the principal activities performed within each of the areas and of the activities common to all three.

b. Materiel Responsibilities. ARMCOM is generally responsible for all gun type weapons and all munitions, but systems/items are fragmented among development elements. Figure I-6 summarizes the materiel item responsibilities, associated major and supporting materiel items, other mission, technologies, and related comments on the strong points and weaknesses for each development organization. Annex I-C contains further breakouts of materiel responsibilities and representative systems responsibilities.

c. Scope and Representative Materiel. Approximately 1,518 current major items (162 weapons/vehicles, 887 munitions, and 469 tool and tests sets) were developed and produced under the auspices of ARMCOM or its predecessors. Support of these items requires the retention of approximately 51,000 technical data packages. However, only a small percent are in use or require updating during any given fiscal year.

PRINCIPAL ACTIVITIES - MATERIEL LIFE CYCLE - BY MANAGEMENT AREA

DEVELOPMENT	PRODUCTION BASE	LOGISTIC SUPPORT
Research	Production	Supply Management
Development	Manufacturing Methods and Technology	Maintenance Management
Exploratory	Mobilization Planning	Technical Assistance
Advanced	Plant Operations	Readiness Reporting
Engineering	Base Modernization	New Equipment Training
Engineering		Malfunction Investigation
Producibility		Accident/Incident Assistance
Military Adaptation of Commercial Items (MACI)		Storage a/
Product Improvement Programs (PIP)		Distribution a/
Manufacturing Methods & Technology (MMT)		Transportation Management
Support to Quantity Production		Modification Management
		Demilitarization
		Integrated Logistic Support (ILS)

COMMON TO ALL AREAS

Procurement	Packaging
Configuration Control	Transportability
Quality Assurance	Provisioning
Human Factors	Manuals
Reliability, Availability, & Maintainability (RAM)	Testing
	Technical Support
	Safety Assessment

a/ Directed by armament community but performed by depot type activities not part of armament community

Figure I-5

Summary of Armament Materiel Responsibilities & Technologies

ORGANIZATION	MATERIEL			TECHNOLOGIES
	MAJOR ITEMS	SUPPORTING ITEMS	OTHER	
Picatinny Arsenal	Large Caliber Ammo (less cart case and projectile metal parts) Nuclear Munitions (adaption kits) Rocket and Missile warhead section Demolitions, Mines, Grenades	Munitions (e.g., bomblets, grenades) Fuzes (Mechanical) Safing/Arming Devices Explosives Propellants Bomblet Dispensers & Dispersers Plastic materials	Explosive Ordnance Disposal Procedures National procurement for Army nuclear munitions	Ballistics - Interior, Exterior, Terminal Energetic materials Lethality Other normal supportive
Frankford Arsenal	Small Caliber Ammunition Fire Control systems/equipment Propellant Actuated devices	Large Caliber projectile ammo metal parts Tracers for all ammunition Mechanical time fuzes/timers Cartridge cases	National procurement mission for Small Arms Ammunition and Fire Control	Optics Non-ferrous metallurgy Materiel degradation Corrosion preventatives Ballistics - Interior, Exterior, Terminal Energetic materials Other normal supportive
Edgewood Arsenal	Offensive chemical agents (including riot control) Defensive chemical and biological material Flame, smoke and indendiaries Chemical munitions (artillery, small arms, rocket and missile warheads - bombs)	Collective protection for vehicles and aircraft Detection and warning devices Decontamination equipment and agents	Control, disposal and license for Army of radioactive material. Provides technical escort for all Army radiological material and all DoD chemical and biological agents and such munitions plus other hazardous items prescribed by Secretary of Agriculture and Surgeon General of US Public Health Lead laboratory for pollution abatement.	Ballistics - Interior, Exterior, Terminal Wound Ballistics Medical sciences; biochemical assessment Environmental toxicology Metrology
Rock Island Arsenal	Small arms weapons (crew served and individual) Major caliber artillery weapons (carriage, recoil, mounts) Tank weapons including turrets and cupolas Gun, Air Defense weapons Aircraft gun weapon systems	Weapons and mounts for vehicles Common tool sets and maintenance equipment	Demil of CONUS small arms weapons and parts	Ballistics - Interior, Exterior, Weapon mechanism Armament applications
Watervliet Arsenal	Cannon (breech and barrel) Mortars Recoilless Rifles		National procurement mission for major items.	Ballistics - Interior, Exterior Physical Sciences and Materials High pressure physics
Ballistic Research Labs	No materiel mission; Specializes in scientific and technical endeavors.	Ballistics, vulnerability, and vulnerability reduction; basic research in physics, chemistry, mathematics, and engineering; nuclear weapons effects; materiel and structure hardening (ARM)	BRL is an independent laboratory reporting directly to HQ AMC.	Ballistics - Interior, Exterior, Terminal Lethality and Vulnerability Physical sciences, and materials Systems modelling and testing

FIGURE 1-6

Some representative types of weapons and munitions are shown in Figure I-7.

5. Mission Fragmentation and Interfaces. a. Internal. Within the armament community the important interfaces between development and logistics activities are more numerous and complex than in other commodity communities because of the division of the missions among seven organizations. Figure I-8 attempts to describe the division of armament materiel engineering responsibilities and the resulting fragmentation in the armament community. One of the most difficult interfaces is the transition from essentially hand-made R&D or LRIP quantities into full mass production. This will continue to be a difficult transition but should not be increased if proper ADC/ALC joint planning is accomplished. No appreciable changes in methods of handling TDPs or modernization (MMT) programs are foreseen.

b. External. The armament community must interact with a large number of external organizations. For example, the development, production, and fielding of the 155mm Howitzer (Towed), XM198 requires extensive coordination with several agencies, each having a significant responsibility, with its development, its transition to full scale production, and its logistic support. During the development phase, at least 26 major organizations must coordinate the execution of their responsibilities with respect to the system as shown in Figure I-9. In the production and logistics support phase, four major ARMCOM staff elements and at least 26 major organizations must coordinate functions. Currently, responsibility for assuring full coordination in both phases rests with the ARMCOM commander. For a different system, (missile warhead section, tank weapon, or aircraft weapon system) some interfaces would change (different commodity commands project managers) but the majority would remain. The figure does not show some of the unusual interfaces which occur such as:

(1) Investigation of 175mm gun malfunction in Israel.

(2) Operation of the National Bomb Data Center for the Justice Department.

(3) EOD technical assistance and equipment for Suez Canal clearing operation.

c. Concept Impact. Establishing a development center with all or most of its elements collocated will reduce the number of internal interfaces during development and thereby assist the management of the development effort. However, the organizational command separation of development from logistics will alter these interfaces and will increase the number of interfaces with organizations outside

WEAPONS AND MUNITIONS

INFANTRY

Rifle, 5.56mm, M16A1	CTG, 5.56mm, Ball, M193 CTG, 5.56mm, Tracer, M196 CTG, 5.56mm, Dummy, M199 CTG, 5.56mm, Blank, M200 CTG, 5.56mm, Grenade, M195
Machine Gun, 7.62mm, M60 Mount, Tripod, Machine Gun, M122	CTG, 7.62mm, Blank, M82 CTG, 7.62mm, Ball, M80 CTG, 7.62mm, Duplex CTG, 7.62mm, Tracer, M62 CTG, 7.62mm, High Pressure Test CTG, 7.62mm, Dummy, M172
Mortar, 81mm, M29	CTG, 81mm, Illuminating, M521 CTG, TP, M43A1 Projectile, 81mm, Training, M68 CTG, 81mm, Leaflet, MK112 CTG, 81mm, HE, M43 CTG, 81mm, HE, M362 CTG, 81mm, HE, M374 CTG, 81mm, Smoke, WT, M375 Fuze, PD, M524A5
Rifle, Recoilless, 106mm, M40A2 Mount, Recoilless Rifle, 106mm, M79	CTG, 106mm, HEAT, M344 CTG, 106mm, HEP-T M346 CTG, 106mm, APERS-T, M581

ARTILLERY

Howitzer, SP, 155mm, M109A1	CHG, Prop, 155mm, M119 CHG, Prop, 155mm, XM164 CHG, Prop, 155mm, XM201 Proj, 155mm, Smoke, WP M110 Proj, 155mm, HE, M107 Proj, 155mm, Gas, VX, M121 Proj, 155mm, Tactical CS, M631 Fuze, MTSQ, M582 Fuze, Prox, M514

ARMOR a/

Tank, Combat, 105mm Gun, M60A1 Trainer, Tank Gunnery, 105mm, Gun, M30 Range Finder, Fire Control, Laser, AN/GVS-3	CTG, 105mm, TPDS-T, M724 CTG, 105mm, APDS-T, M392 CTG, 105mm, APERS-T, M494 CTG, 105mm, TP-T, M490 CTG, 105mm, WP-T, M416 CTG, 105mm, HEP-T, M393E1

AIR DEFENSE

Gun, AA, SP, 20mm, M163	CTG, 20mm, HEI, M56 CTG, 20mm, TP-T, M220 CTG, 20mm, HEIT-SD, M246

AIRCRAFT

Launcher, Grenade, 40mm, M751	Link, CTG, 40mm, M16 CTG, 40mm, Smoke, Yellow, M676 CTG, 40mm, WP, M574 CTG, 40mm, HE, M384 CTG, 40mm, HE, M406

MAJOR ITEMS

MISSILE WARHEAD SECTION

Warhead Section, M234 (Lance)
Adaption Kit, Training, M246
Warhead Section, HE, XM188
Warhead Section, Practice, XM198
Warhead Section, Practice, M252
Warhead Section, Training, M248
Warhead Section, Training, M201
Warhead, Atomic, Training, W70-3

TOOLS AND TEST EQUIPMENT

Radar Antenna Drive Repair Shop, Truck Mounted (VADS)
Shop Equipment, Battery Servicing, Shelter Mounted
Tool Kit, Guided Missile Maintenance, Digital Repeater, Pershing 1A
Tool Kit, Special (Nuclear) Weapons, US Army Artillery School
Wrench Set, Spanner, Field/Depot Maintenance
Honing Machine, Bench Mounted
Shop Equipment, Dry Cleaning, Ship Mounted, Shop No. 36
Welding Shop, Trailer Mounted
Tool Kit, Guided Missile, Organizational Maintenance, HAWK
Tool Kit, Guided Missile, Electrical Repairman

NOTES: a/ - Weapons portion of M60A1 includes M140 Gun Mount, M68 cannon, fire control, add-on stabilization, and basic issue items.

b/ - Abbreviations

AA - Anti aircraft Artillery
APDS-T - Armor Piercing Discarding Sabot - Tracer
APERS-T - Anti personnel - Tracer
CHG - Charge
CTG - Cartridge
HE - High Explosive
HEAT - High Explosive Anti tank
HEI - High Explosive Incendiary
HEIT - High Explosive Incendiary Tracer
HEP-T - High Explosive Plastic - Tracer
mm - Millimeter
MTSQ - Mechanical Time Super Quick
Proj - Projectile
Prop - Propelling
Prox - Proximity
SP - Self-Propelled
TP-T - Test Practice - Tracer
TPDS-T - Target Practice Discarding Sabot - Tracer
WP - White Phosphorous
WP-T - White Phosphorous - Tracer

FIGURE 1-7

PRINCIPAL DIVISIONS OF ARMAMENT MATERIEL RESPONSIBILITY

	LARGE CALIBER (Above 40mm)		SMALL CALIBER (40mm and Below)	
ORGANIZATION	WEAPONS	AMMUNITION	WEAPONS	AMMUNITION
PA		Complete Round (ICM, HE, NUC)[a/] Projectile Warhead Fuze Propellant Primer		Filler
FA	Fire Control	Projectile Metal Parts Fuze	Fire Control	Complete Round Cartridge Case Projectile Warhead Fuze Propellant Primer
EA	Protective Equipment	Projectile Warhead		
RIA	Recoil Mechanism Carriage		Receiver Barrel	
WA	Tube Breech Recoilless Rifles Mortars			
BRL	Vulnerability Interior Ballistics Transitional Ballistics	Vulnerability Lethality Exterior Ballistics Interior Ballistics Terminal Ballistics	Vulnerability Interior Ballistics Transitional Ballistics	Vulnerability Lethality Exterior Ballistics Interior Ballistics
HDL		Fuze		

a/ ICM = Improved Conventional Munitions
HE = High Explosive
NUC = Nuclear

Figure I-8

REPRESENTATIVE COORDINATION REQUIREMENTS

EXAMPLE: HOWITZER, SELF-PROPELLED, 140mm, XM-1 (HYPOTHETICAL)

DEVELOPMENT PHASE COORDINATION

INTERNAL		EXTERNAL	
MAJOR FUNCTION	RESPONSIBLE ORGANIZATION	MAJOR FUNCTION	RESPONSIBLE ORGANIZATION
Program Management	HQ ARMCOM (Project Manager)	Materiel Requirements	TRADOC/Marine Corps
Breech/Tube	Benet Lab (thru Watervliet)	Personnel Requirements	TRADOC/Marine Corps
Recoil/Carriage	Rodman Lab (thru RIA)	Training Requirements	TRADOC/Marine Corps
Overall Ammunition	Picatinny Arsenal	Program/Budget/Schedule	AMC/DA/DoD
Explosive/Propellant	Picatinny Arsenal	Vehicle	TACOM
Projectile Metal Parts	Frankford Arsenal	Communications Equipment	ECOM
Chemical Ammunition	Edgewood Arsenal	Test & Evaluation	TECOM/OTEA
Fuze	Frankford, Picatinny, HDL	Calibration	MICOM
Fire Control	Frankford Arsenal	Development - Production	Industry
Defense, Chemical/Biological	Edgewood Arsenal	Quality Assurance	DCAS
Ballistics/Vulnerability	Ballistic Research Labs	Contract Administration	DCAS
Integrated Logistics Support	All above	Nuclear Warhead	AEC
		Common Items	DSA/GSA/TACOM/TROSCOM
		Transportability	Air Force/Navy/DOT

PRODUCTION/LOGISTICS SUPPORT PHASE COORDINATION

INTERNAL		EXTERNAL	
MAJOR FUNCTION	RESPONSIBLE ORGANIZATION	MAJOR FUNCTION	RESPONSIBLE ORGANIZATION
Overall Management	HQ ARMCOM	Training	TRADOC
Inventory Scheduling	NICP	Secondary Items Program	DA/AMC
Modification Scheduling	NMP	Policy, Funds, Priorities	DA
Configuration Control	ARMCOM RDTE	Repair Parts List & Consumption	TACOM/ECOM
Production Scheduling	ARMCOM P&P	Major & Secondary Items	Industry
Cannon Production/Procurement	Watervliet Arsenal	Stockage/Distribution	Army Depots
Recoil/Carriage Production	Rock Island Arsenal	LLC Exchange/Stockpile Reliability	AEC
Ammunition Production	Ammunition Plants	Supply Stockage/Maintenance	Marine Corps
Technical Support/Assistance	All Development Organizations	Contract Administration	DCAS
		Quality Assurance	DCAS
		Movement	Air Force/Navy/Common Carrier
		Tools & Support Requirements	DSA/GSA
		New Equipment Training	FORSCOM/USAREUR/TRADOC
		Technical Assistance	FORSCOM/USAREUR/TRADOC
		Foreign Military Sales & Military Assistance	Department of State and Foreign Governments in coordination with DA and DOD

Figure I-9

the armament community such as those listed in Figure I-9. This trade-off must not be allowed to degrade effective external coordination and communication, especially with the user.

6. Total Resources. In FY74 one-fifth of the AMC personnel were in the armament community; they worked with one-fourth of AMC's total budget, and used about one-third of the AMC capital investment (land, equipment, facilities).

a. Personnel.

(1) Distribution. The in-house armament community is comprised of approximately 26,000 military and civilian personnel. Some 32,000 contract personnel operate the ammunition plants. Nearly 12,000 personnel are in research, development, test, and engineering of all types. This includes both technical personnel plus their administrative support and base operations. This figure includes about 4,500 scientific and engineering professionals and about 2,100 technicians. For comparison, there are 11,302 personnel in the next largest AMC commodity command, ECOM. Figures I-10 and I-11 show a summary distribution of personnel by installation, by activity (development or logistic), and by function (mission or base operations). Annex I-D shows skill and grade structure breakouts of professionals and technicians and a detailed distribution of personnel by activity and function. A comparison of commodity command personnel strengths is presented in Annex I-I.

(2) Figure I-12 provides data on scientific and engineering professionals and technicians under 50 years of age and those 50 and older. The distribution of those over 50 varies from a low of 24 percent in Rodman Laboratory to a high of 44 percent at Edgewood Arsenal. Recent hiring freezes and reductions in force have driven up the average age and prevented recruitment of new talent. This age profile, with over one-third of the critical skill personnel 50 years and over, suggests that during formation of an ADC sufficient expertise would be retained to maintain effectiveness while retirement and other attrition would permit recruitment of some new blood for revitalization.

b. Funds.

(1) Total Armament Budget. The armament budget for FY74 was $2.7 billion, distributed by budget category as shown in the Figure I-13.

ESTIMATED PERSONNEL DISTRIBUTION BY ACTIVITY
CURRENT ARMAMENT COMMUNITY

Activity	Development	Logistics	Other	Total
HQ ARMCOM	731	3,260	0	3,991[a/]
RIA	838	2,860		3,690
PA	4,871	667	10	5,548
WA	607	2,147		2,754
FA	1,903	1,541	185	3,629
BRL	892	0	0	892
EA	1,935	421	0	2,356
Pine Bluff		1,125		1,125
Rocky Mountain		723		723
Ammo Plants		999		999
TOTAL	11,777	13,743	195[b/]	25,715[c/]

a/ Includes 225 personnel assigned to PM Offices for CAWS, VRFWS, SA, SAF & DeMil.

b/ Missions to be reassigned to other government agencies.

c/ Includes 1,197 Military.

Figure I-10

PERSONNEL DISTRIBUTION BY MISSION/FUNCTION
CURRENT ARMAMENT COMMUNITY

Mission/Function	Development	Logistics	Other	Total
System Technology[a/]				
Small Caliber	644	136	0	780
Large Caliber	2,576	274	0	2,850
Ballistics	618	0	0	618
Chemical	915	79	0	994
Mission Support	1,091	564	0	1,655
Technical Support	2,139	3,396	0	5,535
Admin Support	1,398	1,719	0	3,117
QA & Procurement	1,160	1,635	0	2,795
SUB-TOTAL W/O BASE SPT & OTHER	10,542	7,803	0	18,346
ADC Base Support	1,235	1,624	0	2,859
Log Base Support	0	1,469	0	1,469
TMDE, PAD/CAD	0	0	195[b/]	195
Chemical Manf & Demil				
Pine Bluff	0	1,125	0	1,125
Rocky Mountain	0	723	0	723
Ammo Plants	0	999	0	999
TOTAL	11,777	13,743	195	25,715[c/]

a/ Personnel devoted to research and developmental efforts.

b/ Missions to be reassigned to other government agencies.

c/ Includes 1,197 Military.

Figure I-11

AGE DISTRIBUTION
SCIENTIFIC AND ENGINEERING PERSONNEL
(PROFESSIONAL AND TECHNICIAN)

	Under 50		50 and Over		Total	
	Number	%	Number	%	Number	%
HQ ARMCOM	399	61	253	39	652	100
PA	1,565	62	976	38	2,541	100
FA	739	57	565	43	1,304	100
EA	586	56	462	44	1,042	100
Rodman Lab	382	76	121	24	503	100
Benet Lab	201	66	105	34	306	100
BRL	454	74	162	26	616	100
TOTAL	4,326	62	2,644	38	6,970	100

SOURCE: CIVPERSINS, 30 September 1974

Figure I-12

Budget Breakout and Comparison - Armament versus Total AMC

FY 74 Program
($ Million)

Category	Budget Dollars: Total AMC	Budget Dollars: Armament Portion	Budget Dollars: Armament Percent
PEMA	5,181	2,130	41% a/
RDTE	1,567	210	14%
OMA	1,938	225	12%
Other (incl ASF)	1,543	122	8%
Total	$10,229	$2,687	26%

a/ Ammunition represents $1,687 or nearly 80% of Armament PEMA.

Figure I-13

(2) Development and Logistics Portions. Summarized in Figure I-14 is an apportionment of the armament budget between development and logistics. Estimates of FY 74 expenditures in PEMA and OMA categories for activities that might be assigned a development center, e.g., development MMT, major PIP, general engineering in support of initial or quantity production, or for technical support of fielded items were made. Engineering funded by PEMA which is not included in the ADC concept mission (such as production line modernization) appears in the logistics column.

Apportionment of Armament FY 74 Program Budget Between Development & Logistics
($ Million)

Category	Development	Logistics	Total
RDTE	210	-	210
PEMA	108	2,022	2,130
OMA	29	196	225
Other	0	122	122
TOTAL	$347	$2,340	$2,687

Figure I-14

Figure I-15 shows the appropriation program distributed to the total armament community to include the amount administered by HQ ARMCOM for other distribution and headquarters operating costs. The PEMA dollars distributed to some of the arsenals is a result of its assigned national procurement mission; for example, small arms ammunition to Frankford Arsenal, and, therefore, does not in all cases reflect the magnitude of effort which might be attributed to an ADC.

Shown on Figure I-16 is a different view of the RDTE FY 74 and prior year program available to the armament development community during FY 74. The breakout by mission category indicates the relative involvement of each activity in each of the RDTE areas. Approximately 50 percent of the advanced development and the engineering development funds were distributed to PA. Of the community's exploratory development funds, BRL received the largest portion, with EA and PA following in that order. Of the armament RDTE budget the total

DISTRIBUTION OF ARMAMENT PROGRAM AVAILABLE IN FY 74
($ Millions)

	PA	FA	WA	EA	RIA	BRL	HQ ARMCOM[a/]	Total Program
RDTE	$ 66	23	12	33	18	36	22	$ 210[b/]
PEMA	132	266	51	40	84	+	1,557	2,130[c/]
OMA	16	23	4	15	27	+	140	225
ASF	1	25	25	10	14	0	39	114
Other	1	0	3	3	1	0	-	8
TOTAL	$216	337	95	101	144	36	1,758	$2,687

+ Denotes less than 1 million dollars.

a/ Includes headquarters operations and balance of ARMCOM mission.

b/ Includes distribution of PM Programs

c/ Includes Weapons/Combat Vehicles ($210.5) and Ammunition ($1,687.0).

SOURCE: ARMCOM Review Analysis Report 30 June 74 and Activity Data Submissions, July 74.

DATE: November 1974

Figure I-15

ARMAMENT RDTE PROGRAM AVAILABLE FY 74
($ Million)

Category Mission/Code	PA	FA	EA	RIA	WA	BRL	Total Program
Research 6.1	$ 3.9	1.5	2.8	0.7	1.5	9.0	19.4
Exploratory Development 6.2	13.4	9.6	18.5	4.6	1.6	19.3	67.0
Advanced Development 6.3	15.1	5.4	6.1	4.8	0.3	1.8	33.5
Engineering Development 6.4	32.2	7.3	5.9	7.2	8.2	1.0	61.8
Management and Support 6.5	1.9	0.4	0.6	0.5	0.3	0.6	4.3
Operational System Development 6.7	3.0	0.3	1.1	1.0	0.1	-	5.5
Other	-	2.6	-	-	-	6.4	9.0
TOTAL[a/]	$69.5	27.1	35.0	18.8	12.0	38.1	$200.5
(Customer FY 74 portions in above)	(12.6)	(10.0)	(4.8)	(7.5)	(1.7)	(15.7)	(52.3)

a/ Category reported totals include dollars transferred between activities and therefore do not compare with actual issued dollars shown.

SOURCES: HQ ARMCOM RDTE data 30 June 74 and Activity data submissions, July 74.

DATE: November 1974

Figure I-16

combined shares of RIA and WA is only 15 percent. Approximately $11 million were transferred between activities within the armament community, an indication of intradependence. Figure I-17 depicts the available Program Distribution by the armament development community. For the RDTE program, approximately 35 percent was out-of-house; 15 percent, transferred to other government agencies; and 20 percent contracted to private industry. A more detailed breakout of funds transferred within the development community and program distribution for each activity is presented in Annex I-E1, Annex I-E2 respectively.

c. Facilities and Equipment. The armament community has holdings of almost 300,000 acres of land and 19,000 separate buildings with 86 million square feet of floor space, all with an estimated replacement value of almost $9 billion. As a base line for a development center, the land areas of the primary development installations, were listed and facilities and equipment were apportioned between development activities and logistic activities using judgment of experienced personnel. Annex I-F summarizes the data on land, facilities, and equipment.

SUMMARY OF ARMAMENT FY 74 DEVELOPMENT PROGRAM DISTRIBUTION
($ Millions)

Budget Category	Activity	In-House $	In-House %	OGA & Contract $	OGA & Contract %	Total
RDTE	PA	$ 38.7	58	$ 27.5	42	$ 66.2
	FA	12.4	54	10.4	46	22.8
	EA	29.7	89	3.6	11	33.3
	RIA	16.7	92	1.5	8	18.2
	WA	10.9	93	0.8	7	11.7
	BRL	22.3	62	13.5	38	35.8
	HQ & PMs	5.5	25	16.3	75	21.8
	TOTAL	$136.2	65	$ 73.6	35	$209.8
PEMA	PA	$ 51.3	67	$ 28.8	33	$ 76.1
	FA	11.8	83	2.5	17	14.3
	EA	7.9	89	1.0	11	8.9
	RIA	3.8	84	0.7	16	4.5
	WA	3.2	86	0.5	14	3.7
	BRL	0.2	100	0.0	0	0.2
	HQ & PMs	-	0	0.8	100	0.8
	TOTAL	$ 78.2	72	$ 30.3	28	$108.5
OMA	PA	$ 7.9	95	$ 0.4	5	$ 8.3
	FA	6.6	83	1.4	17	8.0
	EA	5.1	100	-	0	5.1
	RIA	2.5	93	0.2	7	2.7
	WA	4.4	100	0.0	0	4.4
	BRL	0.0	0	0.2	100	0.2
	TOTAL	$ 26.5	92	$ 2.2	8	$ 28.7
GRAND TOTAL		$240.9	69	$106.1	31	$347.0

Figure I-17

SECTION C: Comments on Major AMARC Findings. During visits and interviews with those inside the community and those outside but working with it, an attempt was made to validate the major AMARC findings that led to the recommendation for a separate ADC and those appropriate to its operation and organization.[1/] Although there was general agreement with most of the AMARC findings, there were disagreements, especially as to the professional qualifications of individuals in certain laboratories.[2/] Comments on major AMARC findings follow:

1. Focus on Readiness. AMARC's study charter directed a focus on the "materiel acquisition," or development, phase of the life cycle. When AMARC found that the principal focus of the commanders of the commodity command was on readiness and not on development, they accurately described a situation that had been purposely created. Principal focus of the Army is on tasks that contribute to the combat readiness of today's forces. Clearly, when there is a competition for management attention, the obligation of funds for current production of ammunition is more important to the ARMCOM CG than a development program whose payoff, if any, is several years distant. In ARMCOM, as in other commodity commands, a single commander is directly responsible for operational activities in both readiness and development areas. The ratio of dollars distributed to these armament communities is a more dramatic indicator of the attention they would and should get from top management. Of ARMCOM's FY 74 budget of $2.7 billion, 90 percent was for readiness functions and 10 percent for development. Also the armament community employs approximately 14,000 government and 32,000 contractor (GOCO) personnel in logistics in contrast to approximately 12,000 in development. The AMARC conclusion that management of the development function should be split from logistics seems to rest on their perception that the cost to the development activities by their relegation to

---

1/ Some have criticised the AMARC report by believing it was written by a group of "industrialists" who made recommendations in their own interests rather than the Government's. It is worth noting that the AMARC team most critical of the Army's armament record was headed by a life-time federal employee, a former Technical Director of the Naval Weapon Center, China Lake. Other team members included both a former top manager at China Lake during its period of greatest productivity, and the current Director of the Jet Propulsion Laboratory, a recognized center of excellence.

2/ A discussion of other strengths and weaknesses of the community is contained in Annex I-G. Also, some topics that should be given special consideration in the implementation of an ADC are discussed in Annex I-H.

a secondary role has been too high and not necessary. Their recommendation implies that by raising the level of management, the benefit to development will not cost an unacceptable degradation in readiness. It is clear that there are very close ties within the commands among elements in development, production, and field support activities and that the development activities are heavily involved in supporting readiness. High on the list of the important contributions shown visitors are interesting samples of how the developers were able to respond immediately to problems in production and in the field. Also, it appeared that many managers and the productive, creative individuals in development activities spend much of their time "fighting fires," that is, solving day-to-day problems, many of which concern readiness. A discussion with executives of Bell Laboratories revealed that a similar problem is resolved in their corporate structure by using separate but cooperating development and production entities. The parent organization (AT&T) deliberately employs an organizational separation to prevent its development activities (Bell Laboratories) from becoming too heavily absorbed in problems of the production element (Western Electric).

2. Personnel. In the personnel and personnel management area, there is agreement with almost all AMARC comments. The prime area of disagreement was with the quality of the work force.

a. The military and civilian personnel management systems hinder placing the best available man in the job; however, not all of the rules are imposed by regulations, but some are self-imposed. During the study many very good, technically competent, dedicated people were found working on armament. There is the usual amount of deadwood also, but many people within the organization have justifiable pride in what they have done and what the organization has done. It was also observed that several individuals are characterized as "producers." They are skilled, motivated, mature, and knowledgeable enough to make the system produce in spite of its inherent handicaps. These people will continue to be the *sine qua non* of any organization.

b. Almost universally accepted by interviewees, and confirmed by some visits, was a "can't-do" attitude on the part of many supporting administrative staff personnel. This takes the form of a strict adherence to narrow interpretations of civilian personnel regulations, procurement regulations, programming and budgeting regulations, and the like. A standard answer is, "You can't do that," instead of, "We'll find a way to do it."

3. Fragmentation of Missions. AMARC commented on fragmentation of a mission area among two or more commodity commands. The present study found a similar fragmentation within the armament community, e.g., small arms weapons at Rock Island and small arms ammunition

and fire control at Frankford. Emphasis on avoiding duplication has generally resulted in specialization and the restricting of development or production capability to one location. One might expect that the disadvantages of having multiple development and production sites would be offset by having exclusive customers collocated with their supporting capability, but this is not the case. The current system with its fragmented missions and pockets of specialists, widely separated geographically, is obviously inefficient; however, there are consequences much more serious. In hardware development programs there has been a lack of interaction among those working on ammunition, those doing ballistic studies (most are done in BRL, an organization not under the control of ARMCOM), and those working on the different components of gun systems. Although the coordination process is formalized and requires considerable time and effort, it is clear that in many cases a true coordination has not been achieved. The cost of the coordination was paid, but the tough questions were not asked; hence, no benefit was received and managers thought all was well. For additional serious effects, see paragraph 5 below.

4. Link to the User. Although some remedies have been undertaken, the link between the developer and the user is poor. This is caused in part by communication problems (stemming from differences in background and perception), by inadequate performance and professional qualifications of participants in the areas in which they should be expert, by fuzzy assignment of responsibility and lack of accountability for decisions, and by lack of an effective integrator of the inputs from both communities. Related specific weaknesses include the following:

a. Design and maintenance engineers rarely observe field conditions of user (FORSCOM and overseas commands).

b. Few combat arms personnel in the developer community.

c. The poor accountability for decisions reached in both the user and developer communities may result in part from lack of early involvement by middle and high level management in substantive discussions and agreements reached at the working level.

d. Lack of aggressiveness in reaching out to the other side. This appears due to the fact that no individual or office has specific responsibility at HQDA or elsewhere for insuring that the necessary interactions take place and that they are adequate. Meetings are held but, as in the case of the interactions within the armament community, all the real issues are not necessarily addressed. Visits to TRADOC, the user's representative, and actual using units in USAREUR confirm that the link between the developer and user is weak. Commanding General, TRADOC, is attempting to improve this link; but it appears that the development community must

show strong initiative in keeping the users apprised of new developments and product improvements and must aggressively extract from the user the information needed.

5. Link to the Resource Allocator. Also mentioned briefly by AMARC was a need for a good link between the development community and the resource allocator: namely those individuals in AMC, DA and DOD who are in the decision making process. The difficulty sensed by AMARC stems partly from the rapid changeover of decision makers in the intermediate and higher headquarters, who tend to become critics of new ideas too early in the development cycle. It is believed that this is caused mainly by their short tenure in the decision making role and a reluctance to fully support programs of a long term nature. The development community must work to instill greater confidence in the decision maker, concerning new ideas and early development, by introducing him to the user and his general expression of need. It should be cautioned that the development community currently suffers from micromanagement by these same headquarters - (the other dangerous extreme) - brought about because of a poor track record. This situation requires change because of its inhibiting and stultifying effect on the community.

6. Rigidity in the System. Interviews with personnel reveal that their approaches to problems have become rigid and inflexible. This appears based in part on their perception of the intent of the coordinating procedures mentioned in paragraph 3 above. Those who reported that they attempted to break out of the system, and were well supported by logic, failed and became frustrated. In the recent past, formal coordination requirements have increased, there have been increasing requests for information, and there is an increasing degree of supervision from intermediate and high-level management. This trend seems fueled by failures in certain development projects that have eroded confidence in the system. It appears that the corrective actions which are attempting to reduce failure are also reducing the probability of success. The work force is becoming inflexible, performing "by the book," and not exercising imagination and innovativeness. It is believed that all in the system are contributing to the condition. Although laboratory personnel complain about increases in paperwork, it seems they are more comfortable doing the paperwork than seeking responsibility and performing at the bench. Management, rather than holding an individual accountable for poor performance, issues directives that are seen as additional and unnecessary restrictions by the good performers and have no effect on the poor ones. Confidence within the system must be restored. A fresh start with a new Armament Development Center may help, but the confidence now missing in the present system is essential to successful creation and operation of an innovative and productive development center.

7. Staff Layering. Although AMARC gave the Army credit for starting to reduce staff layering, there is still room for additional and considerable reduction in staffs involved in developmental activities. Within ARMCOM a development team leader and his team members too often must go through the levels of branch, division, directorate, arsenal command, ARMCOM staff, ARMCOM command, AMC staff, AMC command, and often to the DA staff action officer and staff chief to get resolution of a problem. It is not clear what of substance is added at each level. Recent attempts to use systems engineers or product managers to raise the leader at least past the division and directorate level have not had time to demonstrate their effectiveness. Meanwhile, each layer, and each concerned office within each layer, exercises its prerogatives to direct both the management and technical aspects of each program.

8. "Not Invented Here" Attitude. Some evidence of a "not invented here" attitude was found within the system. This attitude of individuals applies not only to hardware, but in some degree to management techniques, to analysis techniques, and to almost every other facet of the system. In its critical aspect it has some benefit; ideas are not blindly accepted but are critically reviewed. Also, if it is derived legitimately from justifiable pride in one's accomplishments, it may be good. In its resistance to outside ideas simply because they come from outside, it is bad. A continuing, aggressive program to ventilate the system is essential.

9. Summary. The previous discussion has covered a number of findings of the AMARC committee. In general, they do present a rather dim view of the current armament community; however, it should be noted that prior to AMARC several important steps had been taken by management to address the same problems. The WECOM-MUCOM merger, to bring the management of guns and bullets together under ARMCOM, is one example. Other actions as part of the AMC TOAMAC I & II and CONCISE studies are aimed at bringing about further efficiencies in the current system. The recent announcement of the closure of Frankford Arsenal as part of the CONCISE study will further consolidate the armament mission. Although these steps have been taken, further improvements are indicated and greater efficiencies are achievable. It is apparent that action to achieve these improvements can be taken as a continuation of those previous, and in progress, without the need for a settling period.

CHAPTER II

ARMAMENT DEVELOPMENT CENTER CONCEPT

CHAPTER II

ARMAMENT DEVELOPMENT CENTER CONCEPT

INTRODUCTION

In this chapter a number of conceptual alternatives for an Armament Development Center are presented. Common to these conceptual alternatives are the mission, functions, organization, and method of operation. Variables include the degree of consolidation of activities from the present structure, geographic sites for the center, distribution of organizational elements among the sites, and manning levels. Details on the alternatives and the major steps taken to arrive at them are also contained in this chapter.

SECTION A: Methodology and ADC Objectives.

1. Methodology. After study of the current acquisition process, the objectives of the Armament Development Center were established. Next, the organizational concept, mission, functions, and concept of operations were developed through an iterative process. The concept of operations was designed specifically to achieve the objectives while preserving the strengths and correcting the weaknesses in the current system. In recognition of the fact that people, not structure, will actually accomplish the stated objectives, the organization was designed to assist and not hinder their efforts. Next, various sites were considered and the best candidates were selected; finally, the alternatives were developed. A parallel but separate effort involving the logistics elements (supply, maintenance, follow-on production and related procurement activities) of the armament community was conducted to develop a general concept for an Armament Logistics Command (ALC). The ALC study served two purposes: first, a check of the effect on the logistics elements after the development activities had been extracted from ARMCOM; and, second, a check on the need for structure and staffing in the ADC (and ALC) to meet the life cycle management responsibilities, either primary or supporting, during the life of a materiel item.

2. Concept Team. To develop and analyze options on the organization, operation, and size of the ADC, the committee used an in-house team whose members were selected for their knowledge, experience, and objectivity. This team was assisted by a group of carefully selected field representatives from affected installations who are experts in their particular mission areas and possess a broad knowledge of activities in the entire armament community. The team was also assisted by consultants from outside the armament

community, each with extensive experience in management of research, development, or production activities. Two of the consultants had served on the Science and Technology Team of the AMARC and another is a member of the Army Scientific Advisory Panel. A list of team members is at Annex II-A . A summary of activities is at Annex II-B.

3. Objectives. The objectives established for an Armament Development Center are listed below:

a. Major Thrust Objectives:

(1) Improve armament acquisition: improve timeliness of developments, increase efficiency, and emphasize output.

(2) Pursue coherent armament mission-oriented efforts.

(3) Provide for intensive management of research and development; separate from logistics management.

(4) Improve responsiveness by better coupling with the user and the resource allocator.

b. Management Objectives:

(1) Incorporate management innovations: use a systems approach; develop strong marketing capability; use advisory panels effectively.

(2) Define lines of authority and responsibility; reduce layering.

(3) Achieve flexibility in management, work force, and execution of research and technology program.

(4) Improve professionalism, motivation, innovativeness, and pride in military and civilian employees.

(5) Develop an implementation plan which will obtain best qualified people within applicable Civil Service Regulations.

c. Development and Acquisition Process Objectives:

(1) Insure continuous technical reconnaissance of activities in other US agencies, in universities, research centers, in industry, and in foreign countries; exploit opportunities revealed.

(2) Insure that Army is an intelligent buyer; develop appropriate balance between in-house and out-of-house effort.

(3) Strengthen technology base; SPEF 6.1 and 6.2 programs.

(4) Improve early application of modelling and simulation.

(5) Improve bond between technology base and full-scale development activities; integrate producibility and procurement expertise early in the development cycle.

(6) Foster and deliberately plan for sound, evolutionary product improvements.

(7) Stimulate in-house productivity through involvement of industry and other government laboratories to secure the best technology and design; facilitate technology transfer.

(8) Provide proper attention to risks, program growth, and human factors.

(9) Improve costing capability.

(10) Use "Red Team" for independent, objective analysis.

(11) Develop method for continuing self-evaluation of materiel acquisition process.

SECTION B: Overview, Mission, and Functions.

1. Overview. The core of the Armament Development Center (ADC) comprises four laboratories, three systems development laboratories--Large Caliber Weapons, Small Caliber Weapons and Chemical--supported by a fourth laboratory, Ballistics Research. The ADC will be responsible for the complete spectrum of systems acquisition from research through development to the transition to quantity production for newly developed or improved items. The center is to assume the research, development, and engineering missions of Picatinny, Rock Island, Watervliet, and Frankford Arsenals, the Ballistics Research Laboratories, and Edgewood Arsenal. Scientific and engineering spaces are allocated to support areas critical to the Army while taking full advantage of the economies of consolidation. In addition, management innovations will be used to emphasize a "new way of doing business," and contribute to revitalization of the armament acquisition process.

2. Mission. In the mission statement below, the principal areas of responsibility are sequenced to emphasize the "output" orientation of the center.

ADC MISSION

For assigned armament systems, components, and related materiel:

- Develop product improvements and new items and provide for transition into quantity production; make initial procurement.
- Maintain a strong technology base--in government, industry, and universities--from which to evolve improved items and to prevent technological surprise.
- Provide technical support to agencies with operational and logistics responsibilities for fielded items.

3. Major Functions. The ADC's functions derive directly from the mission statement; and, although they may appear to address only development items, they are intended to include commercial items or those developed by foreign military developers or others.

Missing from the function statements are modifiers such as "timely," "appropriate," and "efficient," frequently used to make a sentence more precise, but excluded here to permit focus on the essence of the function. The functions are grouped under the applicable element of the mission statement.

a. Develop product improvements and new items.

(1) Accomplish full-scale development of an item whose requirement has been approved by HQ DA.

(2) Provide engineering, costing, and other technical support to agencies responsible for preparation or approval of requirements.

(3) Develop advanced development prototypes for use and test so that the military worth and cost implication may be assessed by users prior to their formal statement of a requirement.

(4) Develop components, sub-components, and parts for evolutionary improvement of items fielded or in initial production.

(5) Insure availability of technical manuals for newly developed items; task ALC for manual preparation.

(6) Improve manufacturing methods and techniques for producing current items.

b. Provide for transition of newly developed items into quantity production.

(1) Prepare the technical data package for newly developed items and acquire initial production quantities to verify the suitability of the TDP for follow-on procurements.

(2) Control the configuration of the end item until this responsibility is transferred to the agency responsible for follow-on procurement.

(3) Assure availability of proven manufacturing methods and techniques to produce a new item.

c. Maintain a strong technology base.

(1) Solve pacing technology problems associated with innovative concepts and advance the technology base.

(2) Exploit foreign and domestic technologies for potential armament application.

(3) Conduct research in armament-peculiar areas not addressed by others in the scientific community.

d. Provide technical support to operational and logistics agencies.

(1) Maintain the TDP throughout the life of the item.

(2) After transfer of configuration management to the Armament Logistics Command, provide engineering representation to the configuration control board.

(3) Provide technical support for new equipment training.

(4) Provide technical support for updating technical manuals.

(5) Provide technical support for the resolution of field problems, including malfunction investigations.

(6) Provide technical support to the stockpile reliability program.

(7) Participate in the preparation of logistics support plans.

(8) Provide for steady improvement in manufacturing methods and techniques for producing fielded items.

(9) Provide technical support to the logistics agency for preparation of cataloging data.

(10) Accomplish engineering tasks associated with the DOD Standardization Program.

4. Special Functions. Because of its mission in armament and capability in attendant disciplines, the ADC will also perform certain special functions:

a. Chemical Agents and Chemical/Biological (CB) Defense:

(1) Plan and conduct all DOD research and development for chemical agents including medical aspects of defense, and all research and development of Army chemical munitions and CB defense systems.

(2) Plan the chemical stockpile reliability program.

b. Army Nuclear Armament Program:

(1) Conduct liaison with Atomic Energy Commission (AEC)

field agencies and Defense Nuclear Agency (DNA) field installations on the technical aspects of the engineering and production of nuclear munitions.

(2) Conduct liaison with the US Army Training and Doctrine Command in developing and coordinating required operational capability (ROC) documents and specific stockpile-to-target sequences for nuclear munitions. Coordinate draft nuclear warhead military characteristics received from DNA with AMC field agencies.

(3) Provide the Lead Project Officer for joint AEC-DOD (Army) project officer groups.

(4) Plan and execute the nuclear stockpile reliability program.

d. International Programs: Conduct and participate in approved international exchange, development, and standardization programs in areas of assigned materiel.

e. NATO North Atlantic Regional Test Center: Operate the center for assigned ammunition.

f. Act as DA licensee for use and experimentation with radioactive materials.

g. Vulnerability of Materiel to Conventional Munitions: Perform as the AMC Lead Laboratory. Develop vulnerability methodology, assess lethality of munitions, and contribute to reducing vulnerability of Army materiel.

h. AMC Explosive Ordnance Disposal (EOD) Program: Supervise and direct the program, which includes responsibility for the Army Technical Detachment at the Armed Forces EOD Technology and Training Center.

5. Functions Transferred. Functions transferred to the Armament Logistics Command are listed in Volume 4 of this report and in Annex II-C . Functions not contributing to armament development or logistics support are recommended for transfer to another agency or activity. These functions are also recorded in Annex II-C.

6. Assigned Materiel. The ADC would have responsibility for the following assigned materiel, including both nuclear and non-nuclear munitions:

a. Weapon systems for infantry, artillery, and air defense (excluding free rockets, guided and ballistic missile systems).

b. Weapon sub-systems for armor and aviation, and special applications in support of other development centers.

c. Warhead and fuzing sub-systems for free rockets and for guided and ballistic missiles in support of the Missile Command.

d. Fire control equipment for weapons for which the center has system responsibility and, when requested, for sub-systems.

e. Demolition munitions, grenades, explosive barrier systems, pyrotechnics, flame, incendiary, and smoke systems.

f. Offensive and defensive chemical materiel, riot control systems, and all defensive biological and such radiological materiel as may be assigned.

g. Armament related components, devices, and sub-systems.

h. Containers, handling, and ancillary equipment.

i. Special tools and basic issue items for assigned materiel.

j. Training equipment, devices, agents, and simulators relating to assigned materiel (with support from the PM for Training Devices).

k. Test, measurement, and diagnostic equipment for assigned materiel.

l. Ammunition peculiar equipment.

SECTION C: Organizational Concept.

1. Reference Organization and Functions. The ADC will be built upon a core of four laboratories:

Large Caliber Weapon Systems Laboratory

Small Caliber Weapon Systems Laboratory

Chemical Systems Laboratory

Ballistics Research Laboratory

This concept follows the objectives cited earlier, especially those related to systems orientation, clear assignment of responsibility, intensive management of concepts and projects, close bond between technology base and full scale development, and interface with the user. The first three laboratories encompass the full range of activities from research through full-scale development and initial production. The Ballistics Research Laboratory will support the other laboratories in the ballistic technology areas. The reference organization was evolved from an earlier study proposal which established two major core organizations--an Armament Technology Laboratory working in the areas from 6.1 through 6.3a, and a Development and Engineering Department conducting 6.3b, 6.4, and the transition to quantity production. The subsequent evolution to Large and Small Caliber Weapon System Laboratories has provided a clearer assignment of responsibility for complete weapon systems, as well as providing organizational continuity throughout the development process and during the transition to production.1/ It is planned to superimpose a form of intensive management for DA approved projects and also for those concepts which offer promise but for which a final requirement has not been stated. For large projects, project managers will be chartered; for smaller projects, team leaders within the Large and Small Caliber Weapon Systems Laboratories, assisted by dedicated ad hoc team members, will provide this same type of special management. Similar management for selected new concepts for which there is not yet a formal requirement will be provided by leaders of concept teams assigned to the Armament Concepts Office. The organizational elements were developed by building upon this general foundation and with attention to the objectives. The framework is shown in Figure II-1 on the next page. The following discussion explains how each

---

1/ The possibility of some redundancy in this organizational arrangement, e.g., fire control expertise in both large and small caliber laboratories, is recognized. This disadvantage can be mitigated by sharing common facilities (fire control or fuze facilities, for example) if the large and small caliber laboratories are collocated.

ADC ORGANIZATIONAL CONCEPT

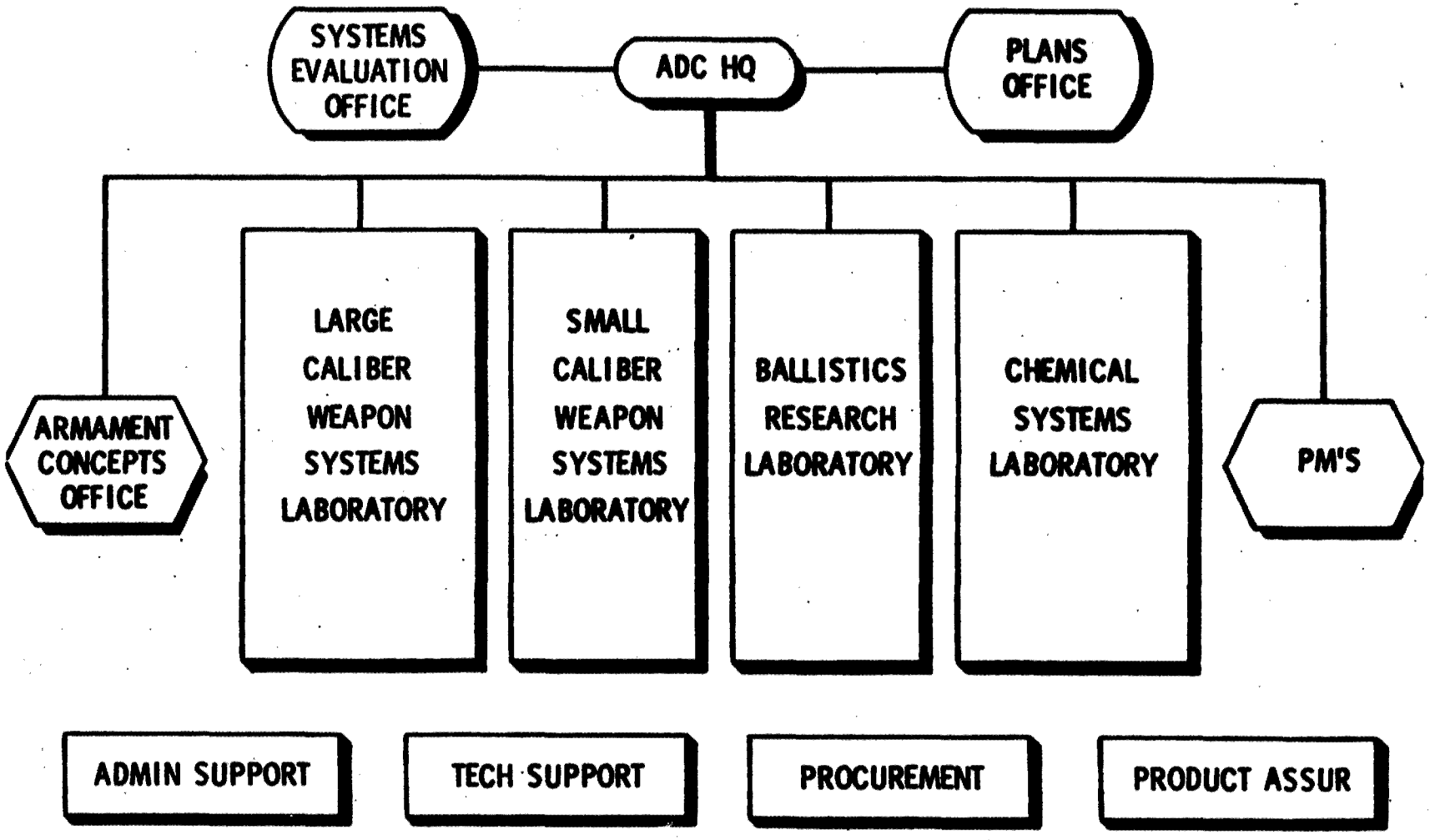


Figure II-1

element will operate within the overall ADC concept. A suggested internal structure for each laboratory is contained in Annex II-D.

a. The Large Caliber Weapon Systems Laboratory. This laboratory, with responsibility for weapon systems larger than 40mm, will conduct the 6.1, 6.2, and 6.3a programs to advance the technology base and build prototypes, components, and subcomponents to establish the feasibility of armament concepts. Feasibility demonstrations will be provided for the user before a firm requirement is established. This laboratory will also work in the 6.3b and 6.4 programs, conducting full scale engineering development and initial acquisition of items for which formal requirements have been established. It will accomplish projects in the PEMA funded categories of product improvements, manufacturing methods and technology, military adaption of commercial items, and other developmental type activities. It will also provide engineering in support of production and other support to the Armament Logistics Command (ALC). The Large Caliber Weapon Systems Laboratory will include the following technology and materiel responsibilities:

Large Caliber Weapon Systems Laboratory

Technology/Engineering:
- Systems Modelling
- Weapon Technology
- Propellant and Explosive Technology
- Systems Development
- Manufacturing Methods and Technology

Materiel:
- Artillery Gun and Howitzer Systems*
- Tank Main Armament*
- Mortars and Recoilless Rifles*
- Missile/Rocket Warhead Sections
- Air Dispensed Munitions
- Mines, Grenades, and Special Items
- Flame, Smoke, Incendiaries, Illuminants

*Including fire control, munitions, and fuzes.

(1) Staffing in the technology area is to permit continuity and stability in programs that serve to advance the technology base while still meeting the needs of concept and project teams. When individuals return from these teams, they should be able to pick up challenging work in the technology base. This will require

organizational depth not present in the current technology community. Technology efforts are to be balanced between in-house and industry and universities to assure that the ADC remains an intelligent customer and that a good technology base is cultivated and maintained out-of-house. The areas emphasized in-house will be those in which the capability elsewhere is not adequate (e.g., explosives and large cannon technology) or those in which there are large data gaps or a lag in technology (e.g., fire control and projectile guidance).

(2) The engineering elements of the laboratory are to operate with a similar flexibility in programs and work force. Mobility between the technology and engineering areas of the laboratory is to be stressed to enhance promotion opportunities, improve communication, and increase management flexibility in responding to changing work load. Engineers are to be available for assignment as team leaders, or as members of project teams or project manager offices. The engineering capabilities of the laboratory will be phased into the concept development teams' efforts as early in the cycle as possible. These capabilities include engineering design, producibility, maintainability, human factors, quality, safety, reliability and performance, and other integrated logistic support (ILS) aspects. The laboratory's engineering staff is to be responsible for product changes throughout the life cycle, for membership on configuration control boards (including those chaired by the ALC), and for updating technical data packages throughout the life of the item. The staff is also responsible for product improvements to correct deficiences, improve cost effectiveness or capabilities, and facilitate production. In addition, the staff will support the ALC with engineering in support of production, in field malfunction investigations, and in other field problems. This activity is essential to correct the immediate problem and insure feedback to the design and development of new systems.

(3) A systems development directorate within the laboratory will be responsible for intensive management of projects not assigned a project manager. Within the directorate, project teams with a leader, necessary system engineers, ad hoc members from weapons, fire control, etc., and marketers, will be formed and tailored to the project. (The concept and role of marketers is elaborated later under the discussion of the Armament Concepts Office.)

b. The Small Caliber Weapon Systems Laboratory, working in weapon systems up to and including 40mm, will operate in the full range of activities and in the manner described above for the Large Caliber Weapon Systems Laboratory. The technology and materiel responsibilities of the Small Caliber Weapon Systems Laboratory are shown below:

Small Caliber Weapon Systems Laboratory

Technology/Engineering:

- Systems Modelling
- Weapons Technology
- Systems Development
- Manufacturing Methods and Technology

Materiel:

- Small Arms*
- Automatic Cannon*

*Including fire control, ammunition, and fuzes.

c. The Ballistics Research Laboratory will conduct technology base programs (6.1 and 6.2) in ballistics and in the vulnerability of targets and materiel in support of the other ADC laboratories, and, when requested, other commands. Shown below are technology area responsibilities of the laboratory.

Ballistics Research Laboratory

Technology:

- Propulsion and Launch Dynamics
- Flight Dynamics
- Terminal Effects
- Vulnerability/Lethality

The vulnerability efforts include enemy as well as US materiel. The laboratory will be responsible for pioneering new frontiers of knowledge and for anticipating and solving pacing problems for the development of improved or new armament components and systems. The laboratory will also be available to solve problems in ballistics encountered by the other laboratories including problems with fielded systems. Personnel will be available to serve as ad hoc members of both concept and developmental teams.

d. The Chemical Systems Laboratory, located at Edgewood Arsenal on Aberdeen Proving Ground, will conduct research, development, and transition to production for chemical weapons and materiel and for chemical and biological defensive measures and equipment.

Chemical Systems Laboratory

Technology/Engineering:
- CB Technology
- Manufacturing Methods and Technology

Materiel:
- Chemical Materiel
- CB Defense Materiel

The current Edgewood Arsenal mission includes additional responsibilities. To permit undivided attention to the CB mission areas, flame, smoke, incendiaries, and shielding from hazardous materials would be transferred to the Large Caliber Weapon Systems Laboratory and aeroballistics and biophysics aspects of flame and incendiaries to the Ballistics Research Laboratory. The Chemical Systems Laboratory will furnish team members to concept teams and development teams.

e. ADC Headquarters. In the ADC, the size of staffs and staff layering has been minimized by delegating authority and responsibility to the lowest possible level. The ADC Headquarters will include the command element, the technical director and two associate technical directors, one for technology and the other for engineering. A deputy commander will be responsible for the link with the user community and serve as a top-level point of contact for industry in their relations with the ADC. This small command group, together with the heads of the four main laboratories, the Systems Evaluation Office, Armament Concept Office, and Product Assurance Directorate, comprise the center's "board of directors." Advisory panels of renowned individuals with scientific, engineering, and management expertise, will assist the board in independent assessment of the overall program and performance. The balance of the ADC Headquarters will include a minimum of administrative and support personnel.

f. The Armament Concepts Office (ACO) and the Project Managers (PMs) are to provide intensive management of selected tasks or projects. ACO teams will work on projects in the conceptual phase, and PMs in the full-scale development and production phases.

(1) Project Managers and Project Leaders. When a new concept

has been successfully demonstrated, and a formal requirement approved and funded, it is intended there be a smooth transition of the project from the concept team to a project manager, or to a project leader within the Systems Development Directorate of the appropriate laboratory. In areas in which industry has a good capability, such as small arms, automatic cannon, and armament subsystems, much of the developmental work, including systems design, will be accomplished on contract. Work in areas such as artillery or tank cannon may have to be accomplished largely in-house.

(a) For project managed items, selection of the PM will follow current practices. He will select his staff, probably largely from the appropriate laboratories. The project office will fund and manage the development program through production, or until production becomes routine and is taken over by the ALC. The PMs staff will include a marketer.1/ Upon completion of its task, the PMs office will be disbanded, and members will return to the laboratories or other positions in the ADC with the project being supported as required from the laboratories.

(b) For items or systems not designated for project management, the Large or Small Caliber Weapon Systems Laboratory will normally be responsible for development. If a project warrants, the ADC commander may create a project office outside the laboratories, with a designated leader reporting directly to him. The Large or Small Caliber Weapon Systems Laboratory would normally assign projects to its Systems Development Directorate, which has systems engineers and marketers; but, here again, the team leader may report directly to the laboratory director. He will normally be selected from the engineering development area of the laboratory. In appropriate cases, the concept team leader may continue as the development team leader. Talents required on the team for particular aspects of the life cycle are brought in as early as practicable. After individuals have fulfilled their assigned task, they return to their normal assigned positions. As with a PM, the development team will carry the project into production and until it is taken over by the ALC.

(2) Armament Concepts Office. The Armament Concepts Office (ACO), a small staff of civilian and military personnel, will collect, develop, evaluate, and exploit ideas and concepts which could provide significant improvements to existing systems or form the basis for entirely new systems. No counterpart of the ACO now exists in the armament community although there is a similar organization at MICOM. Ideas or concepts could come from within the ADC, from user communities, industry, foreign intelligence, academe, other services, or elsewhere.

1/ For further discussion of role and functions of marketers, see subparagraph (c) on the following page.

They could respond to a stated need, or they could be so new and revolutionary that a need had not yet been defined. Worthy concepts will be pursued. Prototypes will be built and given to the user for test and assessment of military worth before formal statement of a requirement. Teams will be formed, a leader designated, and assigned responsibility for a project.

(a) Normally a concept team will have few members and its membership will change as the project progresses and the need for skills changes. The team will fund and direct project activities to include conceptual studies, effectiveness analyses, preliminary engineering systems design, and experimental prototypes to bring the concept to a point at which the user and development community can decide whether or not a requirement should be established. To accomplish its project, the concept team may task in-house elements, or the effort may be pursued in other government activities or on contract. The choice is to be made by the concept team leader. Some concepts may be pursued on dual, parallel approaches. The Chief of the ACO will encourage a good balance between in-house and out-of-house effort among the concept teams' projects.

(b) The team leader, either civilian or military, could come from the technology area of a laboratory or from the engineering development area. If the originator of the idea is a member of the ACO, and he has the ability, he would be selected. The team leader will select team members of appropriate disciplines to provide full capabilities for the task. These ad hoc members may relocate to the team's area or work within their own activity.

(c) Each team will have an individual assigned who is to be responsible for reaching out to the user and then communicating the user's need to the team, to insure that the product satisfies the need, is adequate to the threat, and is acceptable to the user. He must identify the user, a difficult task in itself, and continually interact with him (them) during development to insure that the user's interests are represented in every trade-off. The function goes far beyond mere dissemination of information. He has power which derives from his position as advisor to the team leader on funding decisions, including if and how funds will be spent (in-house or out-of-house) to meet customer's requirements. He also interacts with the resource allocator at all levels including AMC, DA, and DOD, if appropriate, and pushes the team and the contractors to remove operational and administrative obstacles and to expedite approval, funding, and completion (or cancellation) of projects. When he anticipates delays or sees opportunities for speed-up, he forces management decisions, identifying cost, time, performance, and related risk trade-offs in such actions. He monitors relevant developments in other Services and in foreign armament markets to assess the impact on the team's project. The function also requires selling the user, resource

allocator, and others in the decision process on the utility of the concepts or new items (as well as the recognition, in appropriate cases, of the fact that the concepts or items may have no utility). After a long but fruitless search for a better title for the individual who performs these functions, we settled for the label "marketer." It is recognized that this title sometimes denotes one whose sole objective is to sell a commodity, whether good or bad. From the description of his functions, it should be clear that this connotation does not pertain to the ADC "marketer." The "marketers" will be drawn from the ACO's small cadre of experienced officers. The group will include officers of both combat arms and technical services and the US Marine Corps. They should be experienced in tactical operations of infantry, field artillery, armor, air defense, and aviation units. A special study conducted on the user-developer linkage is reported at Annex II-E.

g. Systems Evaluation Office (SEO) will be the center's "red team." This office is to provide the command group independent assessments of current weapon systems (from target acquisition through damage assessment and including logistics) with the objective of identifying opportunities for improvement by upgrading current systems or embarking on totally new systems. This function might be likened to market research. The SEO will also conduct independent systems analyses and cost and operational effectiveness analyses of the center's programs. The SEO members will be expert in fielded armament systems, both US and foreign; and they are to maintain close ties with the user, TRADOC centers and schools, other development centers, other Services, and other major participants in the armament "universe." The SEO will be made up of senior civilian and military personnel, to include combat arms and technical service officers, with broad operational, technical, or managerial experience in armament. SEO personnel will also provide a basic core of capabilities to conduct trade-off analyses. In addition, ADC personnel with proven records will be assigned from other elements on a rotational basis for one to two years. These assignments are to broaden the individual's experience while providing for a continuous revitalization of the SEO. The SEO also will include a small but complete complement of foreign science and technical (FS&T) intelligence personnel to serve all the laboratories. Locating this element within SEO will permit a desired intimate relationship with SEO members. Also, knowing that the SEO "red team" is using the FS&T resources should stimulate laboratory personnel to make greater use of them as well. The output of the SEO is the definition of needs and opportunities, independent assessment, and foreign science and technical intelligence service to the center. Unlike the operating elements, the SEO does not conduct development and thus has no "advocate" role.

h. The Plans Office (PO) will provide staff assistance for ADC corporate planning. In conjunction with the major operating elements, the PO will assist management in developing ADC goals and objectives. The

PO will synthesize programs developed by the operating elements into an ADC program. On a continuing basis, this office is responsible for developing methods for, and then assessing for management at all levels the effectiveness and efficiency of, the organization, structure, and operations throughout the center. This task includes the development and use of performance measurement[1/] on behalf of the operating elements and command group to assess how well the various elements are conducting their operations. A potential option in performing the function of this office is to have its personnel distributed throughout the operating organizations, but controlled by the PO, to perform their programming and performance measurement functions. This office should have funds to contract for management and performance studies to insure that new ways of doing business are channeled into the center.

i. Administrative Support Directorate will include all support activities such as the Comptroller, Civilian Personnel Office, Security, Public Information, Chaplain, Safety, and Travel.

j. Technical Support Directorate will provide all essential support such as computer services, library, range and environmental testing, instrumentation, shops, publications, drafting, documentation, printing, and TDP automated files. Many of the capabilities and services to be provided by this directorate can, as an option, be provided by a government-owned, contractor-operated or contractor-owned, contractor-operated element with a small in-house management staff to oversee and direct the operation.

k. Procurement Directorate will be responsible for executing contracts for research, development, and initial production. An innovative element within this directorate is to be the Office of Procurement and Management Policy (OPMP). It will have direct access to top management whom it will serve as an advisory element and arm. The staff of OPMP will:

(1) Act as the focal point for ADC procurement management and interact whenever necessary with its Army and DOD counterparts to intelligently and persuasively uphold and further ADC's needs.

(2) Act as the focal point for contractors as well as for mission technical and procurement managers for realistic and practical treatment of their procurement needs.

(3) Address itself to the training and development of professionalism in contracting to assure that contracts realistically

---

1/ A basic criterion for any measurement system would be that it imposes no more than a minimal reporting requirement on the operating element.

reflect mission objectives and that the procurement rules and methodologies are being used to provide desired results.

(4) Perform selective management reviews of the contracting activities to measure the overall efficiency and effectiveness. The results of each review are to be furnished on a timely basis to the senior management of each activity involved. The reviews will provide meaningful recommendations to achieve needed improvements.

(5) Maintain a continuing management overview of procurement activities, personnel and grades to assure that such structures are meeting the present and long-term needs of ADC.

1. The Product Assurance Directorate will be responsible for actions through which the conformance of products to quality requirements is predicted and designed into the materiel during the developmental phase, and assured throughout the life cycle. The primary functions will be:

- o Quality design engineering (including the provision of quality engineers to developmental teams, provision of reliability and maintainability support, the preparation of special quality assurance provisions for TDPs, and the establishment of serviceability standards);
- o Participation in test design;
- o Assessment of design safety and reliability--of preeminent importance in explosives and gun tubes;
- o Development and design engineering of acceptance test and inspection equipment;
- o Provision of documentation for procurement (specifications, test and measurement equipment, first article testing);
- o Support to preaward and post-award surveys;
- o Key inspection and first article testing;
- o Operation of quality evaluation laboratory (for nuclear stockpile evaluation and other quality assessments);
- o Metrology and calibration, and

- o Development of improved and less costly product assurance technology.

The Product Assurance Directorate has a large support role in preparing and updating TDPs. The directorate is to provide independent assessments of the quality of materiel being developed and acquired.

2. Manning Levels. Having formulated the ideal of "reference" organization, the next task was to populate it.

a. As a first step, and as a reference, those currently working in the areas defined by the proposed ADC mission and functions statement were identified. These were distributed throughout the "reference" organization to establish a base line.

b. The next step was to determine the appropriate manning levels for a single-site ADC. The first level was established by taking advantage of the economies of consolidation, by eliminating redundancies and inefficiencies, and by building into the new ADC only those capabilities that do not exist elsewhere--in other government activities or in industry. The intent is to use the expertise available elsewhere rather than duplicate it. For example, expertise in electronic fuzes is available at the Harry Diamond Laboratories; and expertise in certain technologies useful in fire control is available at the Night Vision Laboratories, ECOM, and Harry Diamond Laboratories, and would not be duplicated. However, the special expertise needed to design and build a fire control subsystem would be maintained within the ADC. After considering a broad spectrum of expert views on the laboratory staffing and then applying austere standards to support elements, an ADC organization of about 7500 was developed.

c. Recognizing that recruitment might fall below the desired goals, a lower threshold was identified below which the Army begins losing its ability to be a smart buyer. On the basis of in-house and out-house professional judgment, this minimum essential staffing level was determined to be approximately 6400.

d. Figure II-2 on the following page shows the strength of elements of the organizational structure populated at these two levels.

3. Concept of Operation. In the preceding section some elements of the concept of operation have already been discussed in describing the purpose and function of an organizational element. The remaining principal elements of the concept are contained in this section. They have been derived from a study of the current system and other organizations engaged in development activities.

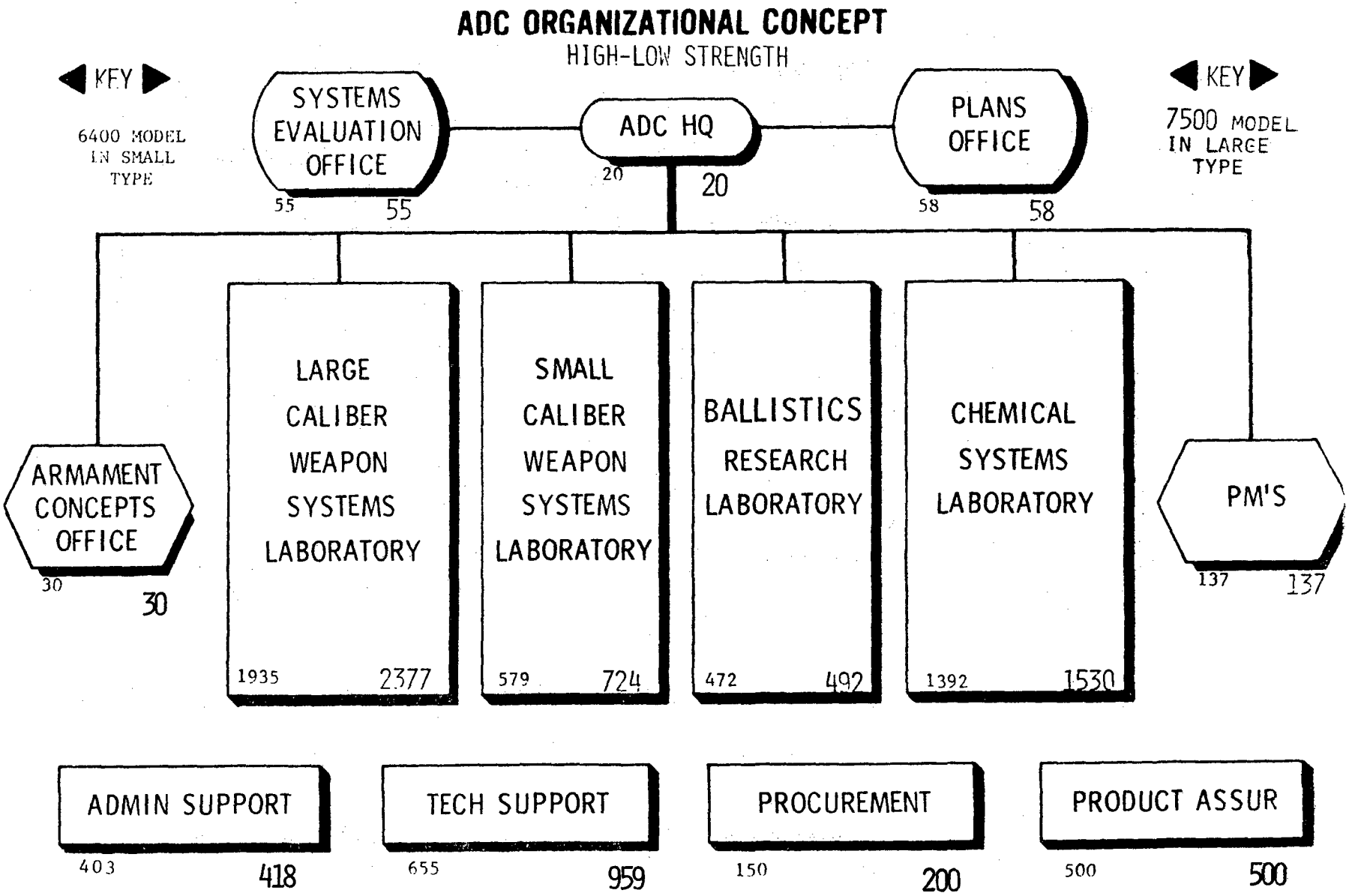
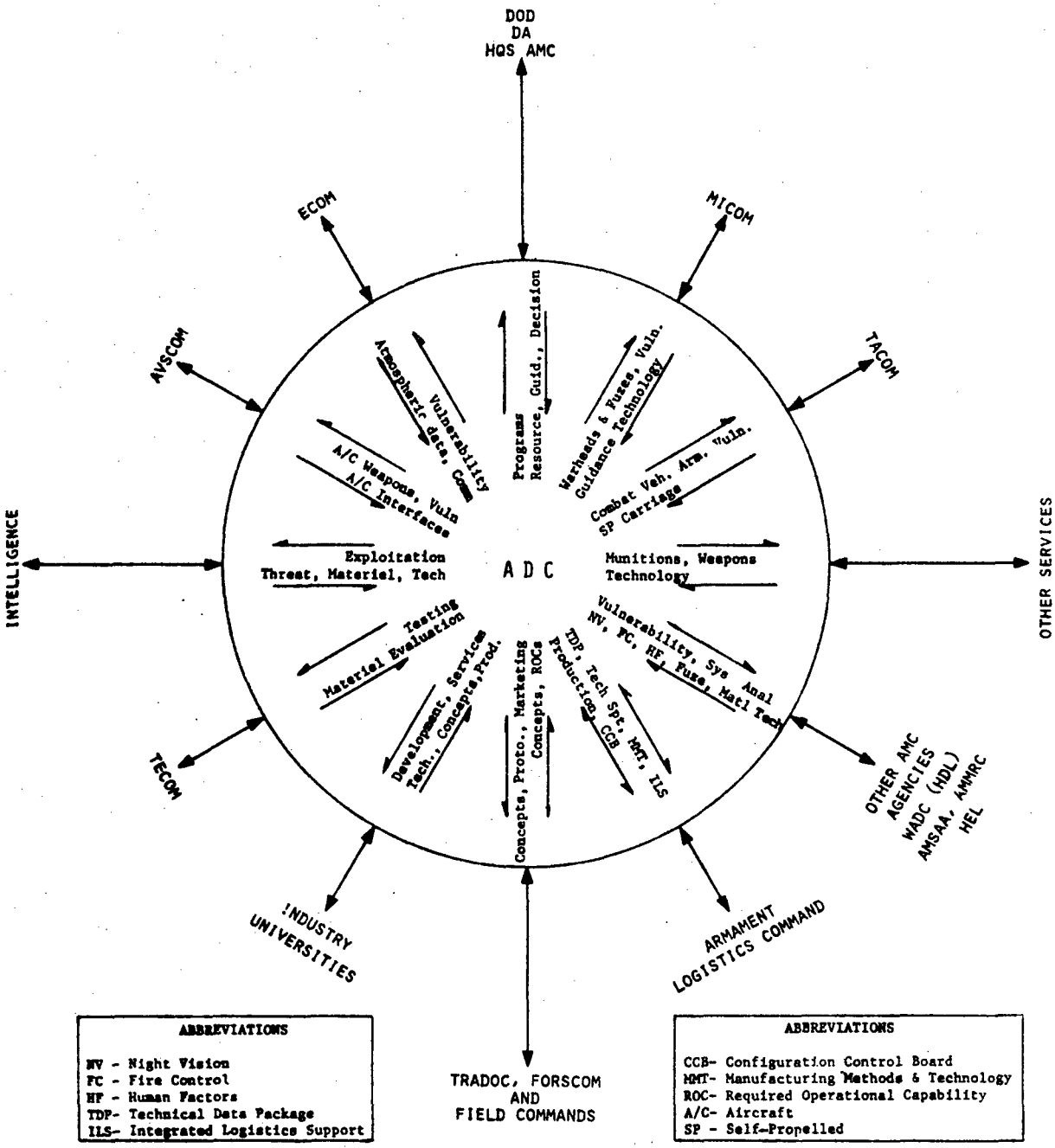

ADC ORGANIZATIONAL CONCEPT
HIGH-LOW STRENGTH
KEY
6400 MODEL IN SMALL TYPE
KEY
7500 MODEL IN LARGE TYPE
SYSTEMS EVALUATION OFFICE
55
55
ADC HQ
20
20
PLANS OFFICE
58
58
ARMAMENT CONCEPTS OFFICE
30
30
LARGE CALIBER WEAPON SYSTEMS LABORATORY
1935
2377
SMALL CALIBER WEAPON SYSTEMS LABORATORY
579
724
BALLISTICS RESEARCH LABORATORY
472
492
CHEMICAL SYSTEMS LABORATORY
1392
1530
PM'S
137
137
ADMIN SUPPORT
403
418
TECH SUPPORT
655
959
PROCUREMENT
150
200
PRODUCT ASSUR
500
500

Figure II-2

a. Materiel Management Responsibilities. Those management responsibilities for a materiel item during its life, that are now assigned to ARMCOM will be divided between the ADC and the ALC. The ADC will have principal responsibility for an item until the technical data package has been validated by the initial production of the item. After this phase, and by mutual agreement, the ALC will assume principal responsibility. Throughout the life of the item each organization will have a supporting responsibility when not acting as principal. Numerous other commands and activities have responsibilities and interface with the ADC during the life of armament materiel items and these are portrayed symbolically in Figure II-3.

b. Reporting Channels. The ADC will report directly to AMC Headquarters. Although this was a "given" in the study directive, it is believed that this reporting channel is essential to assure a break with the old way of doing business. Also, if the ADC is to operate as an independent, self-sufficient arm and be held accountable for how well it performs, the current operation and staffing in AMC Headquarters will require some adjustment. AMC must be prepared to insure that the interactions between the ADC and ALC are taking place. Also, AMC must provide the ADC with the appropriate degree of authority. There is a distinct danger that the ADC may be stifled by micromanagement from its inception unless needed changes in the AMC Staff are planned and implemented in a timely manner. It is in the AMC offices with staff cognizance of ADC activities that any tendency toward oversupervision would have to be restrained. Applying the Single Program Element Funding (SPEF) concept to all science and technology areas should tend to discourage overmanagement since there will be fewer, but larger, dollar projects.

c. Newness. If the ADC is to be a center of excellence and do business in a "new way" and its work force is to be "revitalized" and "bold and innovative," psychological as well as operational changes must be introduced. Of primary importance is the need for every member of the ADC to recognize and accept the purpose, extent, and direction of the changes. A new alignment of management, some new faces, some new buildings or laboratory facilities, some changes in location, some changes in delegation of authority and changes in operational and procedural policies can all contribute to a climate of newness and should be deliberately exploited. It could be fatal to the ADC if it were perceived by those inside or outside as little more than a stirring of the personnel pot or rearranging of organizational blocks. Such is certainly not the intent; but instilling a sense of urgency, openness, competitiveness, and, above



ABBREVIATIONS

NV - Night Vision
FC - Fire Control
HF - Human Factors
TDP- Technical Data Package
ILS- Integrated Logistics Support

ABBREVIATIONS

CCB- Configuration Control Board
MMT- Manufacturing Methods & Technology
ROC- Required Operational Capability
A/C- Aircraft
SP - Self-Propelled

ARMAMENT DEVELOPMENT CENTER INTERFACES

Figure II-3

all, confidence in an organization of 6,400 to 8,300 personnel, most of whom are drawn from the existing system, will require thoughtful planning, vigorous execution, and sustained support from above.

d. Professional Development. Genuine career management and professional development of the work force is to receive continued emphasis to raise levels of knowledge, skill, and motivation. An "armament institute" will be established to provide courses in armament technology; at present there is no university in this country which offers these courses.

e. Use of Military Officers. It is proposed to increase the number of officers from the present two percent of the total strength to nearly seven percent. Officer roles will be varied and all will be challenging. Officers will serve at the operator level as marketers, development team leaders, project managers, and top and middle managers. While it benefits from the officers' prior education, training, and experience, the ADC will provide a training ground for future military managers.

f. Research, Basic and Applied. The center's orientation will be toward applied research to solve pacing problems in support of new armament concepts. To insure technological opportunities are identified for exploitation, the center will monitor basic research done elsewhere, will contract for some, and perform in-house only that necessary and not available from other sources.

g. New Concepts. The ADC will develop new concepts based on technological opportunities. Management will insure that the product responds to the user's needs, is fully adequate to the threat, that trade-offs consider the user's views, and that it is saleable to resource allocators. Producibility, maintainability, quality and other engineering disciplines will be applied appropriately early in the cycle to help shape a practical, useful, and affordable design. New concepts will be reviewed critically to insure that they come to fruition or are cancelled in a timely fashion. The tools of simulation, modelling, systems analysis, and demonstrations for the user will be used.

h. Fielded Systems. The ADC will have experts in the capabilities of currently fielded armament systems. These experts would continuously review these systems and prepare plans for phased improvements to remedy problems, improve the operational performance, or improve cost effectiveness. The ADC will recommend new starts when product improvement will not meet the user's needs.

i. Systems Management. When projects enter full scale development, design engineering will be integrated with the other disciplines of engineering--quality, human, producibility, reliability, maintainability--and with Integrated Logistic Support (ILS) considerations. The ALC becomes deeply involved at this stage. An ILS element of the ALC is to be stationed with the ADC to insure that maintenance, support, and other readiness planning (with input to the design) can proceed in pace with development.

j. Configuration Control. The ADC is to control configuration of new items through use of a configuration control board (CCB); the ADC and ALC will each have members. When procurement responsibility passes to the ALC, chairmanship of the CCB would also pass. Design responsibility and updating of the technical data package (TDP) is to remain with the ADC throughout the life.

k. Transition to Quantity Production. The ADC is to provide for transition of newly developed items into quantity production to insure that the TDP is adequate. Procurement strategy is to be jointly planned by the ADC and ALC early in the full scale development phase. The decision on whether to use the ADC's or the ALC's procurement office to place the initial production contract--and when or if to make the change in procurement responsibility--is to be made on a case by case basis. Most ammunition contracts would likely be awarded by the ALC's procurement office since that office workloads and schedules ammunition production in the GOCOs. Items with very complex TDPs or those in which there is concern for the adequacy of the TDP would be contracted by the ADC procurement office. In cases where few items are procured or they are complex or "bought out" in a relatively short time, the ADC may retain procurement responsibility.

l. Engineering Support of Production. The basic capabilities for engineering in support of production are to reside with the ADC in order to provide support by those with "first hand" design and development experience, to secure the feedback to modify the design, or design new materiel incorporating lessons learned in production, and to keep from building large duplicative engineering staffs at the ADC and ALC. The ALC will plan the man years of engineering support it requires, executing a contractual type arrangement with the ADC. It is not intended that the ALC develop this support as an independent organic capability. Production engineers now in ARMCOM Procurement Directorate, however, would remain as the first line of contact with the day-to-day production problems. The hazard of diverting the ADC from developmental effort to support the ALC in follow-on production is recognized; however, for the reasons stated, this approach should be tried until experience dictates a change.

m. Support of Fielded Systems. Responsibility for field support and malfunction investigation rests with the ALC; the ADC is to provide technical support on call. In the case of malfunctions, the procedures should provide for calling the ADC early while the "clues are still hot."

n. Manufacturing Methods and Technology (MM&T). Manufacturing methods and technology projects, although PEMA funded, are developmental in nature. MM&T is also recognized for its past contribution of large dollar savings and improvements in reliability and safety, especially in munitions. The MM&T function has a place in both the ADC and ALC. The basic responsibilities of the ADC for development and producibility of its products, require it to have an organic MM&T capability to set up small scale pilot operations. Newly developed processes can be proven as can the producibility of new products involving new process technologies. The ALC needs an organic MM&T capability to direct modernization programs and the establishment of new production lines at the GOCOs (in response to the Project Manager for Production Base Modernization, as appropriate). This will also provide the ALC a technical review and assistance capability for follow-on production. Both the ADC and ALC MM&T contingents should be collocated with the ADC to ease the transfer of knowledge of technology, the product, and the process.

o. GOCO Operations. The ADC concept does not include the use of government-owned contractor-operated (GOCO) or contractor-owned contractor-operated (COCO) operations in any of the basic technology and developmental mission areas as a complete substitute for in-house capability. The ADC must have sufficient in-house capability in design development of materiel in order to be a smart buyer and to communicate intelligently with industry, other services, academe, and other centers of technology. In the technical support area, such as computer services, however, it appears highly desirable for the ADC to contract for much of their needs. This will insure that dependence on a contractor will not prevent the ADC from performing its essential role as a smart buyer.

p. Testing. The ADC will secure the benefits of independent test assessments without an autonomous test organization within the ADC. Test plans will be written by development engineers within the laboratories with contributions and final approval from the Product Assurance Directorate, an independent agency. As appropriate, testing will be conducted by the Technical Support Directorate, within the laboratories, by the contractor, or in the Product Assurance Directorate. Test results will be reviewed by both the development engineer and the Product Assurance Directorate, to provide an independent assessment to management. This procedure should provide the needed check without the high overhead costs and delay attendant to an independent organization. Developed materiel will, of course, be subject to TECOM and other testing required by regulations.

q. Procurement Procedures. The following alternatives for PEMA procurement were considered:

- o All PEMA procurement be done through the ALC procurement office to achieve economies in procurement office staffing.
- o All munitions procured through the ALC procurement office and other items procured initially through the ADC procurement office.
- o Some items which would be "bought out" relatively early remain in the ADC procurement office for the entire buy out.

After study of all alternatives, it appears the ADC should select the procurement office on a case by case basis. The decision on when or if procurement should be shifted from the ADC to ALC will also have to be made on a case by case basis. Accordingly, it is planned that the ADC Procurement Directorate will have a capability for PEMA procurement; resolution of the issues will be based on operating experience.

r. Civilian personnel. One of the most important actions required in building and operating an ADC is establishment of a dedicated Civilian Personnel Office (CPO) that understands and is responsive to the special needs of a development activity. The CPO will be pivotal in:

- o Recruitment of new talent.
- o The transfer of functions and personnel, and
- o Operation of the intensive management concept.

Current Department of the Army policy is stated in CPR 200, Chapter 8, 5, 3(3): "A single civilian personnel office will be established to provide services to all activities located on a single installation." Should the ADC become a tenant organization with CPO priorities established on an installation service basis, it will be difficult for the CPO to respond to priorities and requests of a new ADC. To prevent crippling the ADC at birth, the Armament Development Center must have an exception to policy and have its own civilian personnel office.

s. Link to the User and Resource Allocator. The concept of operations is specifically designed to improve the bond between the developer, user, and resource allocator. In addition to the use of marketers discussed earlier, the ADC command group will pursue close interaction with the Training and Doctrine Command (TRADOC),

the service schools, and higher headquarters. Since the developer has the ultimate responsibility for a project, he should have the greatest incentive for introducing both the resource allocator and the user to new developments at the appropriate time and seeing that the interactions with the resource allocator are close and continuous. The developer must keep the resource allocator informed, and press for timely decisions.

SECTION D: Site Considerations.

1. Methodology. a. When identifying candidate sites, no requirement was established that the ADC be totally located at one site, nor that its location be restricted to one of the current armament development installations. It was recognized that the ideal site is not likely to exist, and that trade-offs among criteria would be necessary. For example, very large areas needed to accommodate long range weapons testing are almost certainly not available adjacent to attractive metropolitan centers. Due to the close hold nature of the study, sources of candidate sites could not be circularized in the normal manner. Instead, a list of 94 sites suggested by personal interviews was prepared. The list was reviewed for completeness by personnel with general knowledge of government installations. All AMC installations were considered in coordination with the AMC Installations and Services Directorate. Likely DOD sites were obtained through the Offices of the Assistant Secretaries (Installations and Logistics) of Defense, Army, Navy, and Air Force, and service contacts suggested by these sources. Appropriate staff agencies of the National Aeronautics and Space Administration and the Atomic Energy Commision were also contacted. A listing of possible suitable sites which have been declared excess was obtained from the General Services Administration. Those sites and installations which appeared to have the characteristics necessary for the ADC were visited. Sites requiring significant real estate acquisition were not considered since it was believed that Congressional approval would be extremely unlikely while DOD installations are being closed. The candidate sites considered are included in Annex II-F, Volume 3.

b. Broad criteria were developed for evaluating and comparing candidate sites. These criteria include the physical characteristics of the site, the attractiveness of the location and community, and environmental and cost considerations. To preclude consideration of obviously unsuitable sites, the criteria for a new single site required sufficient real estate to provide collocation of all testing facilities required by the ADC. The facility requirements under two-site and three-site alternatives were also identified as trade-offs to minimize personnel turbulence and reduce construction. The criteria are included in Annex II-F, Volume 3.

2. Description of Potential Sites. Most candidate sites were eliminated by consultation with knowledgeable personnel and examinations of descriptive reports. The sites eliminated did not meet ADC criteria, or the current mission of the installation was not compatible with the ADC mission. The five current sites and seven other sites considered as potential candidates for the ADC were

visited. These sites are discussed briefly below. Additional details are included in Annex II-F, Volume 3.

a. Frankford Arsenal is unsuitable as a single site for the ADC due to its size (110 acres), its location inside Philadelphia, and lack of modern structures. The closure of this arsenal was recommended in the CONCISE study. The City of Philadelphia in a 29 Nov 74 letter to the President offered to provide 150 acres of land as a potential site and up to 800 additional acres as a single site. Although considered, the offer does not provide sufficient land area for all ADC facilities. Further, environmental and urban encroachment problems would preclude extensive development testing at the proposed location. Both Frankford Arsenal and the real estate offered have been considered as a partial site for selected ADC activities.

b. Watervliet Arsenal also is too small for a single ADC site (147 acres) and is surrrounded by built-up area. The closure of Benet Laboratory at this Arsenal was recommended in the CONCISE study.

c. Rock Island Arsenal is larger (908 acres), but its location on an island closely surrounded by urban areas, and its lack of unused structures and space militate against its selection as the ADC single site. If a portion of the ADC were to be located at Rock Island, most of the required basic facilities would have to be provided by construction or conversion of existing buildings.

d. Picatinny Arsenal occupies over 6000 acres and is a feasible site for the ADC with the exception of sufficient land area for long range weapons testing. Approximately 1,850,000 square feet of administrative, laboratory, and shop space is available and could be made useable for the ADC by appropriate alteration. New construction would be required for some unique test facilities. The relative abundance of existing floor space is in a sense a disadvantage of PA as an ADC site in that properly designed new construction would be more attractive and efficient. The arsenal has ready access to the interstate highway and is within a commuting radius of one hour to many attractive small towns and industrial facilities.

e. Aberdeen Proving Ground is the most attractive of the five current armament development installations as a single ADC site, especially if the Ordnance Center and School (OC&S) is relocated as recommended in the CONCISE study. The relocation of the OC&S is assumed in this analysis for all alternatives involving an increase in the population of Aberdeen. The Aberdeen and Edgewood peninsulas occupy over 40,000 acres, and the reservation boundary

includes about an equal area of water. Including the OC&S, over 1,700,000 square feet of administrative, laboratory, and shop space is available and, with internal relocation of various tenant activities, the existing facilities with appropriate alterations will accommodate the ADC. New construction would be required for the additional unique test facilities. As with Picatinny Arsenal, the disadvantage of existing floor space at APG as an ADC site would provide for less than optimum configuration, making extensive use of facilities designed for other purposes. Urban encroachment and environmental considerations could ultimately become a serious factor limiting, if not precluding, future extensive test firing activities.

f. Dugway Proving Ground occupies approximately 841,000 acres 87 miles southwest of Salt Lake City. The Proving Ground has approximately 636,000 square feet of administrative, storage, R&D, and maintenance and production facilities of which very few are permanent structures. Some family housing and a grammar and high school are on the installation. Its isolated location is further compounded during the winter months when roads become impassable due to severe snowfall.

g. Rocky Mountain Arsenal is located adjacent to the northeast edge of the City of Denver and occupies approximately 17,800 acres. The Arsenal has approximately 1,808,000 square feet of administrative, storage, and manufacturing and assembly space. Many of the facilities are leased to Shell Oil Company and the remainder is utilized by the current mission at the Arsenal. There is insufficient space for long range test firing, and urban encroachment and environmental considerations would probably limit if not preclude extensive test firing activities.

h. Jefferson Proving Ground is located 45 miles northeast of Louisville, Kentucky and occupies 56,000 acres. All existing facilities are utilized in the acceptance testing of production ammunition. The Proving Ground is not subject to encroachment but its range is not expandable. Practically all facilities for the ADC would have to be constructed.

i. Yuma Proving Ground is located 25 miles northeast of Yuma, Arizona and occupies over one million acres. Facilities are being developed for long range testing. All administrative, R&D and maintenance and production facilities are utilized in the current mission of the installation.

j. Fort Irwin is located in the Southern California high desert and occupies over 600,000 acres. It is occupied year around and utilized on a permit basis by the California National

Guard. Heaviest use is during the summer months. The installation has relatively new community support facilities such as 506 family quarters, commissary, post exchange, auditorium, theater, BOQ's, barracks, and hospital. An elementary school is on the site with a high school available in Barstow, a distance of 35 miles. Although firing ranges are available with sufficient distances, range instrumentation and range communications would have to be installed. There are no environmental, urban encroachment or air space limitations. The site is in reasonable proximity to the Los Angeles area as well as to other Army and Defense research, development and test activities. New construction would be required for laboratories and supporting shops.

k. The Laguna Niguel Facility, a GSA facility, is a seven story building completed in 1971 by North American Rockwell on 92 acres, approximately sixty miles southeast of Los Angeles, California. It is suitable as a partial site, with test activities conducted at Fort Irwin or Yuma Proving Ground. It is located in a residential area within four miles of the ocean. The building contains about 800,000 square feet of net useable space, approximately 80% of which is designed for engineering and manufacturing.

l. Plum Brook Station, a NASA facility and the former Plum Brook Ordnance Works, is located near Lake Erie 55 miles west of Cleveland. The station includes 5600 acres and approximately 2000 acres of government-owner buffer zone. NASA personnel have tentatively indicated that most of the land area and some facilities could be made available. The Physical and community aspects of this site are very attractive. Relocation to Plum Brook would be delayed until new facilities could be made available, beginning in late CY 1978 and programmed over several additional years.

SECTION E. Organizational and Site Alternatives:

In this section, elements of the reference organization, described in Section A, are located geographically in the various arrangements depicted in Figure II-4 on page II-42. Actual sites selected were based on the site survey and analysis, the organizational concept, the population and unique facilities now in place, and a rough estimate of relative costs. In all alternatives, the Chemical Systems Laboratory is located at Edgewood Arsenal. In the following chapter the alternatives will be evaluated.

1. Single-Site Alternatives. The site survey and analysis indicate that based on its land and space needs a single site ADC could be located only at Aberdeen or Picatinny among current installations, or at any of a number of new sites with Fort Irwin the leading contender. These single-site alternatives are depicted in the figure as Alternatives 2, 3, and 3A.

2. Multi-Site Alternatives. In the event the costs in dollars or in loss of present expertise associated with a single-site ADC might be considered too high to be acceptable, multi-site armament development center alternatives have been structured. These increase the use of the existing work force and unique facilities over that of a single-site; they also increase the size of the base for analysis, thereby providing for a better comparison of alternatives.

a. Two-Site Alternatives. Aberdeen is the logical first choice for one of the two locations since it, among all the current installations, is the only one with adequate real estate and firing clearance to permit artillery firing to the maximum range. The Chemical Systems Laboratory is also to be located at Aberdeen because of the extensive facilities now there. Movement of this laboratory to a new facility would cause special problems because of the very recent ratification of the Geneva Protocol of 1925 by the US Senate. The Ballistic Research Laboratories with its expertise in ballistics and vulnerability is also now located at Aberdeen Proving Ground. BRL is supported by on-site unique test facilities such as wind tunnels, ballistic ranges, and blast chambers, and neighbors such as HEL, TECOM, and AMSAA. Picatinny Arsenal with its large work force and extensive munitions and explosives facilities is the leading choice for the second location. The work force associated with large caliber munitions and explosives is the largest among the current armament installations--and it would still be the largest element, although reduced, in either of the new ADC model levels. In addition, the large caliber munitions and explosives expertise are critical to the operation of the 26 GOCO ammunition plants since this technology is not available in the private sector. Rock Island, Frankford, or Watervliet are not as good candidates as Picatinny or Aberdeen in

the two site alternatives; their selection would preserve a less critical and a smaller body of expertise, less critical facilities, and less real estate. With location of the Large Caliber Weapons Systems Laboratory at Picatinny, only the Small Caliber Weapons Systems Laboratory remains. The Small Caliber Weapons Systems Laboratory could be collocated with the Ballistics Research Laboratory at Aberdeen Proving Ground where there is a base of small arms and automatic cannon expertise and facilities to build upon. It could also be located at Picatinny Arsenal with the Large Caliber Laboratory where there would be an opportunity for personnel to interact in the functional areas of weapons, munitions, fire control, fuzes, and supporting disciplines, as well as an opportunity to share unique facilities. These two-site options are designated on Figure II-4 as Alternatives 4, 5, and 5A.

b. Special Two-Site Split-System Alternative. Retaining the four basic laboratories as the core but geographically locating all weapons and fire control work at Aberdeen and all munitions and fuze effort at Picatinny is Alternative 5B. Headquarters of both the ADC and all four laboratories are at Aberdeen. In this alternative, both laboratory directors and systems development managers--concept team leaders, project leaders, or PMs--would coordinate the activities on "guns" and fire control at Aberdeen with the "bullets" and fuzes at Picatinny. This option is carried forward for comparative analysis because of the inherent advantages of grouping personnel by technology area, to include sharing of unique facilities.

c. Three-Site Alternative. Rotation of the Small Caliber Weapons System Laboratory beyond the two sites of Aberdeen and Picatinny to Rock Island Arsenal, Frankford Arsenal, or the new site proposed by the City of Philadelphia would generate a three-site ADC. Rock Island (Alternative 6) offers the advantage of the currently resident responsibility and capability for small caliber weapons while Frankford, or the new site, (Alternatives 7 and 8) has the capability in small arms ammunition and fire control with some small caliber weapons capability.

3. ADC Headquarters. It is believed essential that the Headquarters be located with the mass of those people engaged in the truly developmental activities within the ADC. This essentiality derives from both the scope and complexity of the task of creating a development center. Other commentary on the location of the ADC headquarters is contained in Section C1a, Chapter III. In the single-site ADCs the headquarters is located with the center at either Fort Irwin, Aberdeen, or Picatinny. In the two-site alternatives, the location depends on the split of personnel and functions. In the three-site alternatives, it is at Picatinny or at Rock Island. The Rock Island

selection is the single exception to the rule noted above; however, Alternative 6 permits an economic analysis comparison on headquarters locations not otherwise available. Location at Rock Island does have the advantage of permitting close face to face contacts between the ADC and ALC staffs. The relatively small size of the resident population and its program do not make the Frankford Arsenal or the new Philadelphia site suitable locations for the ADC Headquarters (Alternatives 7 and 8).

4. Modified Status Quo. An ADC could be established with all the current development activities remaining in place and having them report to an ADC commander rather than each reporting to a separate arsenal commander. Although this arrangement would provide for a single commander controlling all development type activities in ARMCOM, the mission and work force fragmentation and resultant heavy coordination requirements remain. These appear to be major contributors to the weakness of the present system. This alternative also continues an unnecessarily inefficient operation at a time when the Army is attempting to increase productivity; hence, it will not be considered further as a contender for a preferred alternative.

5. Population. a. Single-site ADCs have been built on the 6400 man model, two-site ADCs on either the 6400 or 7500 man model, and three-site ADCs on the 7500 man model. Each alternative could be manned at either the minimum essential 6400 model level or at the 7500 model level. In the economic analysis, the 6400 and 7500 man models are comparable since they represent the same level of effort. The population difference is balanced by funding for more work by contract in the 6400 man model. (See Annex II-G.)

b. All alternatives are the subject of economic analysis. Alternative 1 as discussed in paragraph 4, above, can serve as both the reference status quo and the cost reference because the differences attendant to the modification are insignificant in terms of costs or personnel movement. Alternatives 4 and 5 were chosen to display the differences in the 6400 and 7500 model two-site ADCs. Alternatives 7 and 8 were selected so as to distinguish in economic terms between the "new" Frankford Arsenal location (offered by the City of Philadelphia) and the old site.

ADC ORGANIZATION, SITE, AND POPULATION [a] ALTERNATIVES

CONFIGURATION	ALTERNATIVE	HQ LOCATION	NEW SITE	ABERDEEN PROVING GROUND	PICATINNY ARSENAL	ROCK ISLAND ARSENAL	FRANKFORD ARSENAL	WATERVLIET ARSENAL	POPULATION TOTAL
BASE	(1)			BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,797	MUNITIONS PROPELLANTS EXPLOSIVES FUZES 4,154	SMALL ARMS WEAPONS LARGE CALIBER WEAPONS 1,383	FIRE CONTROL SMALL ARMS AMMUNITION SHELL METAL PARTS FUZES 1,625	CANNON AND BREECHES MORTARS RECOILLESS RIFLES 583	10,542
ONE-SITE	(2)	FT IRWIN	4,994 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH	1,392 CHEMICAL SYSTEMS					6,386
	(3)	APG		6,386 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS					6,386
	(3A)	PA		1,392 CHEMICAL SYSTEMS	4,994 LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH				6,386
TWO-SITE	(4)	APG		3,585 SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS	3,363 LARGE CALIBER SYSTEMS				6,948
	(5)	APG		4,081	4,002				8,083
	(5A)	PA		BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,402	LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS 5,415				7,817
	(5B)	APG		LARGE CALIBER SYSTEMS SMALL CALIBER SYSTEMS BALLISTICS RESEARCH CHEMICAL SYSTEMS 4,632	LARGE CALIBER MUNITION SUBSYSTEMS SMALL CALIBER MUNITION SUBSYSTEMS 3,364				7,996
THREE-SITE	(6)	RIA		BALLISTICS RESEARCH CHEMICAL SYSTEMS 2,402	LARGE CALIBER SYSTEMS 4,002	SMALL CALIBER SYSTEMS 1,887			8,291
	(7)	PA		BALLISTICS RESEARCH CHEMICAL SYSTEMS	LARGE CALIBER SYSTEMS		7-NEW FA SMALL CALIBER SYSTEMS 8-OLD FA		
	(8)	PA		2,402	4,256		1,633		8,291

[a] FIGURES AT TOP OF BLOCK ARE FOR 6400 MODEL; BOTTOM FOR 7500 MODEL.

Figure II-4

CHAPTER III

EVALUATION OF ALTERNATIVES

CHAPTER III

EVALUATION OF ALTERNATIVES

CHAPTER III

EVALUATION OF ALTERNATIVES

INTRODUCTION

This chapter contains a complete evaluation of the organizational and geographical alternatives described in Chapter II. The content includes that prescribed by AR 37-13, "Economic Analysis and Program Evaluation of Resource Management"; but the format suggested in the AR has been varied and expanded in order to provide special emphasis where considered appropriate. In particular, personnel and operational considerations are discussed in detail; and an effort to determine community economic impact is reported. The overall objective and the general assumptions applicable to this evaluation are stated in the preface to this volume. Additional detailed assumptions applicable to the cost and benefit analyses are stated in Sections A and E respectively.

SECTION A: Cost Analysis.

1. Approach. a. This section concerns exclusively the development of estimates of the costs of implementing each of the eight armament development alternatives listed in Chapter II and of certain variations on these alternatives. Personnel and operational considerations, constraints on scheduling implementation, economic impact on affected communities, and a formal effort to evaluate relative benefits are discussed in subsequent sections prior to the overall discussion comparing the alternatives.

b. The methodology for the calculation of investment and recurring costs and the rationale for all factors used are discussed in summary form in the paragraphs below reporting these costs. Methodology, rationale, and illustrative calculations are described fully in annexes referred to in these paragraphs.

c. The cost implications of these armament development alternatives would be incomplete without consideration of the costs of changes which might be made elsewhere in the armament community as a consequence of implementation of these alternatives. These changes have been analyzed and are described in Volume 4. The impact of their costs on the estimated costs of each development alternative is discussed in the final paragraph of this section.

2. Assumptions. a. That the cost factors, personnel relocation expectations, and disposition of excess current armament developmer community personnel used in developing investment and recurring costs are valid.

b. That the analysis (Volume 4) of changes to be made elsewhere in the armament community as a consequence of each development alternative reflects valid changes and associated costs.

c. That the armament development level of mission effort during the years included in this analysis will remain essentially the same as during FY 74.

d. That the effects of inflation will not vary among alternatives sufficiently to have significant effects on cost comparisons.

e. That the costs of establishing the Status Quo Alternative, which differs in minor respects from the actual status quo, are negligible; and that recurring costs for this alternative are the same as actual FY 74 costs.

f. That the Ordnance Center and School (OC&S) will be relocated from Aberdeen Proving Ground as recommended in the CONCISE Study in all ADC alternatives which add to the current armament development population at APG.

g. That servicing organizations will be available to perform those base operations support functions for which ADC funds but no ADC personnel are provided.

3. One-Time (Investment) Costs. a. Introduction. In order to implement any of the ADC alternative reorganization plans, there are several one-time costs which must be incurred. Although these investment costs may be expended over a period of several years, they do not include any recurring (operating) costs, which are presented in paragraph 4, below. The one-time costs which will be included in this section are: basic facilities construction; unique facilities and equipment; personnel movement, separation and recruitment; and other one-time costs. These costs are summarized in Figure III-1. Each will be discussed below.

b. Basic Facilities.

(1) Construction costs for the ADC conceptual alternatives were developed for basic facilities (administrative, laboratory and shop space). Detailed discussion and calculations may be found in Annex III-A, Volume 3. The number of ADC personnel of each type to be accommodated was selected to match the population concept developed for each alternative. This breakdown by type of workspace required

ONE-TIME (INVESTMENT) COSTS

(CONSTANT DOLLARS IN THOUSANDS)

	ALTERNATIVE							
	1[4]	2	3	4	5	6	7	8
Basic Facilities[1]	0	89,076	24,169	25,292	30,582	37,331	64,387[5]	32,182
Unique Facilities & Equipment	0	134,476	66,798	14,353	14,353	17,106	17,101	7,787
Personnel[2]	0	53,764	40,126	29,856	28,444	26,821	26,652	26,652
Other[3]	0	9,271	6,936	5,093	5,943	5,794	6,134	5,637
TOTAL	0	$286,587	$138,029	$74,594	$79,322	$87,052	$114,274	$72,258

1/ Renovation and general construction costs.

2/ Includes relocation, separation and recruitment costs.

3/ Includes abnormal overtime and TDY, and pack, crate, handle, transport and re-assemble of general equipment.

4/ The FYDP forecasts approximately $20 million in MCA funds for the current armament development community. These investments were not included because FYDP forecasts are historically unreliable, and because the same or equivalent costs would be reflected in all alternatives.

5/ Assumption that the City of Philadelphia will provide required basic facilities ($40,780K) reduces this cost to $23,607, and the alternative 7 total from $114,274K to $73,494K.

Figure III-1

was based on a detailed functional analysis of the conceptual ADC. The allowances for each type of physical space was derived as follows. The DoD 4270.1 Construction Criteria Manual allowance for administrative personnel is 80 to 90 square feet net useable space, Based on this, an allowance of 135 square feet gross was used for new construction. This allowance was increased to 150 gross square feet per person when an existing building is to be converted to administrative space, or existing administrative space is to be altered. There are no standard allowances for laboratory or shop space. Based on a survey of ARMCOM installations and on recent construction projects, per capita values of 400 gross square feet for laboratories and 600 gross square feet for shops were selected as being typical of the research activities involved.

(2) Estimated costs of new construction were derived from AR 415-17, Empirical Cost Estimates for Military Construction and Cost Adjustment Factors, dated 7 June 1974, supplemented by discussion with estimators of the Office, Chief of Engineers, and by data from recent construction projects. In addition, technical advice was provided by the AMC Installations and Services Agency, which is responsible for technical review of AMC-wide construction projects. The values selected were $40.00 per square foot for administrative space, $100.00 for laboratories, and $35.00 for shops. For new construction these values include buildings to the 5-foot line, contingency, and supervision and administrative costs. A 15 percent factor was added for supporting facilities such as utilities beyond the 5-foot line. In accordance with current practice, engineering and design costs were not included. The construction midpoint was assumed to be 1 July 1975; i.e., no allowance for inflation was included. Costs at each location were adjusted by the construction cost index contained in AR 415-17.

(3) Approximate factors for estimating alteration costs were derived from the general rule of thumb that vertical construction costs are one-third structural (foundation and shell), one-third architectural (interior walls and finish), and one-third mechanical and electrical. In adapting space for similar use (i.e., ordnance shop to research and development shop), a factor for alteration and improvement of space of 25 percent of new construction was selected. A factor of 50 percent of new construction was selected for conversion of an existing facility from one use to another (i.e., warehouse to laboratory). Figure III-2, Basic Facility Construction Cost, summarizes the costs per person for new construction, conversion to a dissimilar use and alteration of existing facilities for the proposed ADC locations.

BASIC FACILITY CONSTRUCTION COST
DOLLARS PER PERSON

LOCATION	AREA COST FACTOR	ADMINISTRATIVE			LABORATORY			SHOP		
		NEW	CONV'N	EXIST'G	NEW	CONV'N	EXIST'G	NEW	CONV'N	EXIST'G
ABERDEEN	0.99	6,150	3,420	1,710	45,540	22,770	11,390	23,910	11,690	5,980
PICATINNY	1.07	6,650	3,690	1,850	49,220	24,610	12,300	25,840	12,920	6,460
ROCK ISLAND	1.05	6,520	3,620	1,810	48,300	24,150	12,080	25,360	12,680	6,340
FRANKFORD	1.10	6,830	3,800	1,900	50,600	25,300	12,650	26,570	13,290	6,640
FORT IRWIN	1.14	7,080	3,930	1,970	52,440	26,220	13,110	27,530	13,770	6,880

Figure III-2

c. Unique Facilities and Equipment.

(1) Armament research and development requires specialized major facilities and equipment in addition to the basic equipment normally associated with laboratories and supporting shops. Examples are highly instrumented test firing ranges, high pressure and fatigue test devices, and explosives handling equipment.

(2) In order to determine the ADC requirements for these items, lists of existing unique facilities and equipment were developed by each of the current installations. These lists were reviewed and reduced by eliminating duplications and all items not considered functionally necessary for the conceptual ADC. In addition, for each alternative which includes one or more of the current installations, consideration was given to the facilities and equipment already on site.

(3) In conjunction with personnel at each current installation, cost estimates were developed for each of the items to be relocated or duplicated at the new site. Records of original project costs were useful, but considerable effort was required to identify and remove costs of equipment which can be recovered and to escalate all cost to FY 1974 levels. Where actual costs were not available, the collective judgment of the Committee and knowledgeable AMC personnel was used to estimate the probable cost of dismantling and preparing equipment for shipment, and reinstalling the equipment at the ADC site. Transportation costs were estimated by applying an average of rail and highway rates from the General Commodity Tarriff (DA Pamphlet 700-1), updated to 30 June 1974, to known weights. Consideration was given to unusual foundation and utility requirements.

(4) In Figure III-3, which follows, direct equipment costs are separated from general construction associated with unique facilities. The reason for showing these costs separately is that MCA funds will be required for construction of both basic and unique facilities, while part of or all equipment relocation costs could be funded from other appropriations. Detailed costs and calculations for each alternative are included in Annex III-A, Volume 3.

d. The assumption concerning construction costs for Alternative 7 is based on the following reasoning. For several years, correspondence has been exchanged concerning an alternate site for Frankford Arsenal. In order to include this possibility as an alternative, an effort was made to assume an offer somewhat more generous than was likely to be made. The donation of land and the basic facilities (administrative, laboratory and shop space) for the development population (1633 personnel) was selected. As shown in Annex III-A, Volume 3, the cost of these facilities is estimated to be $40,780,000. The cost to DoD is assumed to be zero, as shown

SUMMARY OF FACILITIES COSTS ($000)

ALTN	HQ	CONSTRUCTION				UNIQUE EQUIPMENT				TOTAL
		RENOVATION	GENERAL	UNIQUE FACILITIES	TOTAL	DISMANTLE PACK/CRATE	INSTALL	TRANS	TOTAL	
2 (1 Site)	Fort Irwin	1,068	88,008	121,298	210,374	5,833	5,949	1,396	13,178	223,552
3 (1 Site)	APG	937	23,232	61,212	85,381	2,319	3,210	57	5,586	90,967
4 (2 Site)	APG	1,195	24,097	11,495	36,787	865	1,975	14	2,858	39,645
	(APG)	(488)	(10,208)	(5,670)	(16,366)	(326)	(567)	(3)	(896)	(17,262)
	(PA)	(707)	(13,889)	(5,825)	(20,421)	(539)	(1,412)	(11)	(1,962)	(22,383)
5 (2 Site)	APG	1,441	29,119	11,495	42,055	865	1,975	14	2,858	44,913
	(APG)	(576)	(12,285)	(5,670)	(18,531)	(326)	(567)	(3)	(896)	(19,427)
	(PA)	(865)	(16,834)	(5,825)	(23,524)	(539)	(1,412)	(11)	(1,962)	(25,486)
6 (3 Site)	RIA	1,776	35,555	13,547	50,878	1,153	2,384	22	3,559	54,437
	(APG)	(218)	(4,579)	-	(4,797)	-	-	-	-	(4,797)
	(PA)	(858)	(17,333)	(5,825)	(24,016)	(539)	(1,412)	(11)	(1,962)	(25,978)
	(RIA)	(700)	(13,643)	(7,722)	(22,065)	(614)	(972)	(11)	(1,597)	(23,662)
7 (3 Site)	PA	1,128	22,479	13,547	37,154	1,153	2,384	17	3,554	40,708
	(APG)	(218)	(4,579)	-	(4,797)	-	-	-	-	(4,797)
	(PA)	(910)	(17,900)	(5,825)	(24,635)	(539)	(1,412)	(11)	(1,962)	(26,597)
	(FA-NEW)	-	(40,780) a/	(7,722)	(7,722)	(614)	(972)	(6)	(1,592)	(9,314)
8 (3 Site)	PA	1,992	(29,698)	5,825	37,515	539	1,412	11	1,962	39,477
	(APG)	(218)	(4,579)	-	(4,797)	-	-	-	-	(4,797)
	(PA)	(910)	(17,900)	(5,825)	(24,635)	(539)	(1,412)	(11)	(1,962)	(26,597)
	(FA-OLD)	(864)	(7,219)	-	(8,083)	-	-	-	-	(8,083)

a/ New FA general construction costs assumed to be zero; basic facilities provided by the city.

Figure III-3

in the footnote to Figure III-3. The actual offer was made in a 29 Nov 74 letter from Mayor Rizzo to the President. It included a donation of 150 acres of land as a site for current arsenal activities or for these and additional small caliber development activities. Facilities estimated to cost approximately $100 million would be funded through a bond issue, with debt service provided by annual lease payments. The amount of the bond issue would be partially offset by the proceeds of the sale of Frankford Arsenal. The value of this offer to the federal government is limited to the land and the convenience of a construction loan (the bond issue). In a sense, there is an additional value to the DoD and DA if the procedure of retiring a portion of the bond issue through the sale of the arsenal is allowed; but this additional value would be provided by the federal government (the owner of the arsenal), not by the city. Thus the value to the federal government of Alternative 7 as defined exceeds the value of this offer by $40,780,000; and the value to DA exceeds the offer by the difference between this figure and the sale price of the arsenal.

e. One-Time Personnel Costs and Turbulence.

(1) Personnel turbulence includes relocation of current personnel to new sites, recruitment, and accommodation of current personnel who do not relocate. The basic methodology for the computation of one-time personnel costs is predicated on an analysis of the current base line RDTE functional spaces and population. From this analysis and the application of various experience factors, the distribution and turbulence estimates were determined for the ADC reorganization alternatives. Once these personnel values were determined, a set of cost factors was applied to derive the estimated costs associated with each alternative. This methodology is described below. Resulting estimates are summarized in Figure III-4. Further detail and justification for factors used may be found in Annex III-B, Volume 3. The results of similar calculations for variations on the basic alternatives are included as an appendix to the annex.

(2) The method for calculating the personnel distribution and turbulence included four basic steps. The first was to approximate a distribution of the present RDTE functional spaces as they might appear in the new ADC alternatives. This was accomplished through a functional analysis of the present community coupled with the independent structuring of the new ADC under various configurations and populations. The new ADC functional spaces were allocated to each current RDTE organization represented in the current RDTE base line population of each organization. The functional analysis and resulting distribution of spaces established the maximum job availability in the ADC for personnel from each current RDTE organization.

SUMMARY

ONE-TIME PERSONNEL COSTS
(CONSTANT DOLLARS IN THOUSANDS)

	ALTERNATIVE							
	1	2	3	4	5	6	7	8
Cost Categories	STATUS QUO	FT IRWIN	APG	APG/PA (Low)	APG/PA (High)	APG/RIA/PA (HQ RIA)	APG/FA/PA (HQ PA)	APG/FA/PA (HQ PA)
Current Personnel (Relocate)	N/A	$11,365	$20,493	$14,844	$14,566	$15,695	$15,325	$15,325
Place OGA (Relocate)	N/A	7,352	5,002	3,972	3,318	2,759	2,772	2,772
Separation (RIF)	N/A	11,884	12,128	9,632	8,057	6,688	6,725	6,725
Terminal Leave	N/A	914	369	407	365	399	522	522
Recruitment (Relocate)	N/A	21,595	1,954	917	1,958	1,172	1,198	1,198
Recruitment Charge	N/A	654	180	84	180	108	110	110
Sub-Total	N/A	$53,764	$40,126	$29,856	$28,444	$26,821	$26,652	$26,652
Other Costs: (Period)	N/A	(5 Yrs)	(4 Yrs)	(3 Yrs)	(3 Yrs)	(3 Yrs)	(3 Yrs)	(3 Yrs)
TDY	N/A	3,065	2,452	2,001	2,328	2,388	2,388	2,388
Overtime	N/A	3,640	2,912	2,376	2,763	2,835	2,835	2,835
General Equipment	N/A	2,566	1,572	716	852	571	911	414
Sub-Totals	N/A	$ 9,271	$ 6,936	$ 5,093	$ 5,943	$ 5,794	$ 6,134	$ 5,637
GRAND TOTAL	N/A	$63,035	$47,062	$34,949	$34,387	$32,615	$32,786	$32,289

Figure III-4

(3) In the second step, the maximum number of current RDTE personnel expected to be willing to relocate was estimated. Based on the experience in recent similar actions, 20 percent of the personnel are expected to relocate to distant or dissimilar areas, and 45 percent to relocate to reasonably nearby and similar areas in the east coast area. These seemingly high expectations are justified by the specialized nature of armament development functions and by current forecasts of general economic conditions. They are also consistent with recent Army Materiel Command consolidation experience. It is expected that 100 percent of the personnel qualified for an ADC job at their current locations will accept.

(4) The third step consisted of assigning current personnel to ADC jobs up to the limit established either by willingness to relocate or by the number of ADC spaces allocated to the current organization.

(5) The fourth step examined the use of current RDTE personnel at ADC locations but not assigned to ADC jobs in the previous steps. An assessment was made of the probable percentage qualification of these personnel for ADC employment, and jobs assigned accordingly. The remaining unfilled ADC spaces represent required recruitment.

(6) Estimates of the disposition of current RDTE personnel who were not assigned ADC jobs completed the personnel turbulence calculations. Experience indicates that about 25 percent of these excess personnel can be expected to retire or to be lost through normal attrition. The remainder are expected to divide equally between placement with other government agencies (OGA) and separation (RIF action). These expectations are subject to variation in specific circumstances; but they are regarded as sufficiently refined and accurate for cost predictions to be used in the comparison of ADC alternatives. The single refinement included in the calculations shown in Annex III-B was to increase the retirement and attrition percentage in Alternative 2 (Fort Irwin), in recognition of the unique delay in implementation of this alternative.

(7) Personnel turbulence cost factors, developed in Annex III-B are as follows:

Relocation	$6,600/person
Separation (RIF)	$6,400/person
Terminal Leave	$1,900/person
Recruitment	$ 200/person

(8) Relocation costs were applied to personnel moving to ADC jobs, to current personnel placed with nonlocal other government agencies (estimated to be 40 percent of total OGA, and costed to this action although actually paid by the hiring agency), and to nonlocal recruits. The $200 recruitment administrative costs were applied to all recruits. Terminal leave costs were applied to personnel separated or retiring as a result of the reorganization, but were not included for organizations accruing funds for this purpose in accordance with Army Industrial Fund procedures.

(9) Also shown on the personnel cost summary are the estimated abnormal TDY and overtime costs expected during the reorganization. These costs were estimated using previous Army Materiel Command experience. These costs were converted to a per capita basis for use in the cost model of this analysis, as described in Annex III-D.

(10) The final line item shown on the personnel cost summary is the movement of general equipment, which includes desks, files, laboratory and shop equipment, tool sets, etc. The development of estimates of the weight of this equipment to be associated with each relocating administrative, laboratory and shop worker and of the unit costs of shipping and handling are discussed in Annex III-A, Volume 3.

(11) The quantification of training costs was not considered appropriate. The initial lack of productivity of new employees was recognized and compensated for in the allowances for temporary overlap of employment of current personnel and recruits.

(12) The personnel and associated costs are displayed and discussed in greater detail in Annex III-B, Volume 3. The personnel turbulence giving rise to these costs is further discussed in Section B, below.

4. Annual Operating Costs. a. A comparison of the total annual operating (recurring) costs of the major alternatives under consideration in this study is reflected on Figure III-5. These costs are portrayed in constant FY 1974 dollars. A detailed discussion of these estimates may be found in Annex III-C, Volume 3. Part I of the annex states the rationale behind the extension of FY 1974 expenditures as the basis for comparing alternative costs. Part II of the annex is a description of the underlying methodology; Part III includes detailed tabulation of recurring costs for the eight basic alternatives, and comments concerning costs for variations on the alternatives.

b. The ultimate configuration of the ADC is estimated to be achievable by the end of FY 1976 in Alternative 1 (modified status

COMPARISON OF TOTAL ANNUAL OPERATING (RECURRING) COSTS OF ALTERNATIVES
(Costs are reflected as millions of Constant FY 1974 Dollars)

	ALTERNATIVE	YEAR IN WHICH STEADY OPERATIONAL CONFIGURATION IS REACHED	ANNUAL OPERATING COSTS AT STEADY STATE	OUT-OF-HOUSE COSTS	IN-HOUSE COSTS	IN-HOUSE MAN-YEARS	COST PER IN-HOUSE M/Y (INCLUDING CONTRACT BASE OPERATIONS)
1.	STATUS QUO (HQ RIA)	FY 1976	$347.0	$123.9	$223.1	(10,542)	.0246
2.	SINGLE SITE (NEW)	FY 1984	271.8	138.5	133.3	(6,386)	.0241
3.	SINGLE SITE (APG)	FY 1981	280.8	148.0	132.8	(6,386)	.0255
4.	TWO-SITE (APG-PA) (HQ APG)	FY 1981	293.0	148.0	145.0	(6,948)	.0251
5.	TWO-SITE (APG-PA) (HQ APG)	FY 1980	297.9	129.2	168.7	(8,083)	.0251
6.	THREE-SITE (APG-PA-RIA) (HQ RIA)	FY 1980	297.3	123.1	174.2	(8,291)	.0244
7.	THREE-SITE (APG-PA-NEW FA) (HQ PA)	FY 1980	302.0	127.8	174.2	(8,291)	.0250
8.	THREE-SITE (APG-PA-OLD FA) (HQ PA)	FY 1980	302.5	128.3	174.2	(8,291)	.0250

Figure III-5

quo), FY 1980 in Alternatives 5 through 8, FY 1981 in Alternatives 3 and 4, and 1984 in Alternative 2. At that point annual operating costs reach a steady state measured in constant dollars. These costs vary from $347 million in the modified status quo to $272 million in the new single site alternative.

c. Alternatives 3, 4 and 5 include the cost of the ADC's absorbing, in whole or in part, the fixed and semi-variable base operations costs currently identified to the Ordnance School by APG. These costs will have to be borne either through reallocation to existing tenants or absorption by new tenants replacing the school at APG. Alternative 3 reflects a total backfill for costing purposes by the ADC. Alternatives 4 and 5 reflect a partial backfill.

d. The out-of-house costs include mission and base operations workload contracted with the private sector of the economy and other government activities. Alternative 1 envisages continuation of contracting mission workload at approximately the current annual level ($88M); whereas Alternatives 2, 3 and 4 envisage increasing annual mission contractual effort to approximately $118M; and the remaining alternatives, to approximately $95M. In the case of all alternatives other than the modified status quo, base operations out-of-house effort is immediately increased by approximately $18M. This increase is balanced by a corresponding decrease in in-house personnel. The ADC out-of-house base operations effort will remain approximately two-thirds of the total base operations effort; it will be slightly higher for those alternatives which include APG backfill.

e. In-house total cost differentials between the alternatives are primarily a reflection of the differences in in-house man-years of effort in the various alternatives. As a result of the previously discussed shift in the percentage of base operations performed in-house versus out-of-house, the in-house costs per man-year drop by approximately $2K from current levels in all alternatives except the modified status quo. The shift does not affect total cost per person. When out-of-house base operations costs are added to in-house, costs per man-year vary from $24.1K in Alternative 2 (new site) to $25.5K in Alternative 3 (APG). The higher costs in the latter case are attributable to the backfill costs previously discussed. This factor also contributes to the man-year costs in Alternatives 4 and 5. The slightly higher man-year costs in Alternatives 7 and 8 as compared to the other three-site alternatives are attributable to the assumption that ADC would be the sole tenant at a new Frankford Arsenal (Alternative 7) and thus would have to bear all base operations costs, and in Alternative 8 that the existing Frankford Arsenal relatively high historical base operations costs would prevail except for reduction of fixed components through proposed arsenal modernization.

5. Total Costs. a. The investment and recurring costs discussed in paragraphs 3 and 4, above, are combined and further analyzed below. The flow of total investment costs by alternative, by fiscal year, is shown in Figure III-6. Total recurring (operating) costs are shown similarly in Figure III-7. The sum of these flows, or total costs, is shown in Figure III-8. All costs are in constant FY74 dollars. Raw totals and discounted totals are included.

b. Figure III-9 is a summary of differential analyses of these flows. For ease of reference, total investment and steady state operating costs are included. Terms from this table are explained briefly in subparagraph e, below.

c. These figures include Alternatives 3a, 5a and 5b, which were not included in the preceding paragraphs on investment and recurring costs. The estimates for these alternatives are regarded as very nearly as valid and accurate as are those for the eight basic alternatives. Essentially, the same methodology was employed. Reference is made to these additional alternatives in Annex III-A, B, C, Volume 3, as three of five "variations" analyzed. Alternatives 3a, 5a and 5b correspond to variations A, C and D respectively. Variations B and E concerned relocation of a small group of ADC headquarters personnel, and since they did not affect overall costs significantly, were not included in this action.

d. A cost model capable of most of the calculations needed for this analysis is described in Annex III-D, Volume 3. The cost model was used in conjunction with the manual calculations for validation at each procedural step. The value of the model is lessening of clerical error, flexibility in responding to changing input data, rapid sensitivity analysis, and ease of performing any future analyses which may be required. The only significant simplification of manual calculations was to replace the specific year-to-year personnel strength estimates with an assumed linear decrease from initial to final (steady state) strength. This simplification results in omission of the costs of personnel overlap at new and old locations during implementation. The error is small and consistent among alternatives. Neither investment costs nor steady state operating costs are affected.

e. Necessary explanations of terms in Figure III-9 follow:

(1) Implementation time is the period required to reach the final ADC configuration. In some cases only minor events such as transfer of final small groups of personnel occur during the final year. In alternative 2, the time includes an initial two-year delay due to the need for new construction.

TOTAL INVESTMENT (NON-RECURRING) COSTS
(Millions, Constant FY 74 Dollars)

	Alternative										
	1	2	3	3a	4	5	5a	5b	6	7	8
FY 76	0	.9	11.8	8.4	11.3	10.7	9.0	10.5	10.3	10.4	11.1
77	0	.9	17.0	12.0	21.3	20.8	19.6	20.7	19.9	19.8	19.7
78	0	13.1	60.7	26.6	25.4	28.5	35.7	27.9	36.1	23.3	24.8
79	0	64.5	36.9	19.3	7.0	8.5	4.8	8.4	11.5	8.5	7.2
80	0	82.3	11.6	11.3	9.6	10.8	7.4	11.1	9.2	11.5	9.5
81	0	70.1	0	0	0	0	0	0	0	0	0
82	0	54.9	0	0	0	0	0	0	0	0	0
TOTAL	0	$286.7	$138.0	$77.6	$74.6	$79.3	$76.5	$78.6	$87.0	$73.5	$72.3
TOTAL DISCOUNTED	0	$182.8	$107.6	$60.7	$60.5	$63.8	$62.0	$63.1	$69.8	$59.0	$58.5

Figure III-6

Total Recurring (Operating) Costs
(Millions, Constant FY 74 Dollars)

	ALTERNATIVE										
	1	2	3	3a	4	5	5a	5b	6	7	8
FY 76	347.0	347.0	352.8	351.8	352.6	353.1	352.3	353.3	351.3	353.3	353.2
77	347.0	344.4	342.2	339.1	348.3	349.3	347.6	349.5	346.7	351.0	351.4
78	347.0	345.4	309.5	305.7	321.2	323.4	321.6	324.0	320.8	325.5	326.0
79	347.0	341.1	292.2	288.0	296.3	300.5	294.4	299.1	298.2	305.4	305.9
80	347.0	326.3	286.4	281.4	293.1	297.9	287.4	296.4	297.3	302.0	302.5
81	347.0	313.5	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
82	347.0	303.1	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
83	347.0	285.3	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
84	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
85	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
86	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
87	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
88	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
89	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
90	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
TOTAL	5205.0	4508.7	4391.1	4320.0	4541.5	4603.2	4477.3	4586.3	4587.3	4657.2	4664.0
TOTAL DISCOUNTED	2769.1	2495.0	2397.2	2362.6	2467.9	2496.5	2439.5	2489.3	2485.9	2522.4	2525.4

Figure III-7

Total Costs
(Millions, Constant FY 74 Dollars)

	ALTERNATIVE										
	1	2	3	3a	4	5	5a	5b	6	7	8
FY 76	347.0	347.9	364.6	360.2	363.9	363.8	361.3	363.8	361.6	363.7	364.3
77	347.0	345.3	359.2	351.1	369.6	370.1	367.2	370.2	366.6	370.8	371.1
78	347.0	358.5	370.2	332.3	346.6	351.9	357.3	351.9	356.9	348.8	350.8
79	347.0	405.6	329.1	307.3	303.3	309.0	299.2	307.5	309.7	313.9	313.1
80	347.0	408.6	298.0	292.7	302.7	308.7	294.8	307.5	306.5	313.5	312.0
81	347.0	383.6	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
82	347.0	358.0	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
83	347.0	285.3	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
84	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
85	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
86	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
87	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
88	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
89	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
90	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
TOTAL	$5205.0	$4795.4	$4529.1	$4397.6	$4616.1	$4682.5	$4553.8	$4664.9	$4674.3	$4730.7	$4736.3
TOTAL DISCOUNTED	$2769.1	$2677.9	$2505.0	$2423.6	$2528.2	$2560.4	$2501.6	$2552.6	$2555.7	$2581.5	$2584.1

Figure III-8

DIFFERENTIAL ANALYSES

ALTERNATIVES

	1	2	3	3a	4	5	5a	5b	6	7	8
Total Investment ($\overline{M}$)	-	286.6	138.0	77.7	74.6	79.3	76.5	78.5	87.1	73.5	72.3
MCA	(-)	(223.5)	(91.0)	(45.4)	(39.6)	(45.0)	(46.9)	(45.6)	(54.4)	(41.2)	(40.0)
Other	(-)	(63.1)	(47.0)	(32.3)	(35.0)	(34.3)	(29.6)	(32.9)	(32.7)	(32.3)	(32.3)
Steady State Operating Cost ($\overline{M}$)	347.0	271.8	280.8	275.4	293.0	297.9	287.4	296.4	297.3	302.0	302.5
Implementation Time (Yrs)	-	8	5	5	5	4	4	4	4	4	4
Steady State Savings ($\overline{M}$)	-	75.2	66.2	71.6	54.0	49.1	59.6	50.6	49.7	45.0	44.5
Investment Recovery Period (Yrs)	-	10.9	5.0	3.6	4.3	4.6	4.5	4.6	4.6	4.7	4.8
Savings/Investment Ratio	-	1.5	3.46	6.71	4.98	4.27	5.32	4.43	4.06	4.18	4.16
Rate of Return (%)	-	21%	54%	104%	60%	53%	65%	54%	56%	51%	49%
Present Value Cost ($\overline{B}$)	2.769	2.678	2.505	2.423	2.528	2.560	2.501	2.552	2.556	2.581	2.584

Figure III-9

(2) Steady State Savings are the differences between the annual operating cost for alternative 1 (status quo) and for each alternative.

(3) Investment Recovery Period is the time required for the cumulative discounted operational savings to become equal to the cumulative discounted investment.

(4) Savings/Investment Ratio is the quotient of the present value (discounted total) of operational savings over the fifteen-year period of this analysis, and the present value of the required investment.

(5) Rate of Return is that discount rate which makes the present values of the flows of investment and of operational savings equal over the economic life.

(6) Present Value Cost is the sum of the discounted flow of total costs over the fifteen-year period of this analysis.

6. External Costs. a. The primary source of external costs which might affect the validity of the above costs as a basis for comparing alternatives is the actions required within the remainder of the armament community as a consequence of each of the ADC alternatives. The nature of these actions and the approximate cost of each are the subject of the substudy reported in Volume 4.

b. In each case, investment would be recovered through operational savings. The relatively small magnitudes of these estimates and the fact that variation among alternatives is generally similar to the variation of the ADC cost estimates indicate that the estimates reported in the above paragraphs are a valid basis for comparing ADC alternatives.

SECTION B: Personnel Considerations.

1. Flexibility of Work Force. a. Management regards a flexible work force as one which can provide varying levels of specialized skilled effort to match program requirements. The opportunity for cross-training and experience needed to develop work force flexibility improves as the degree of armament development effort collocation increases. The opportunity for application of matrix management techniques through formation of project teams also improves with collocation. The existence of a large and varied development program at a given location is particularly beneficial to the individual who chooses to become extremely knowledgeable in a very narrow specialty, in that his talents can be fully utilized in support of several projects simultaneously.

b. From the management point of view, collocation provides much greater flexibility in utilization, selection, and advancement than could be available in five or six geographically and administratively separated arsenal personnel units.

2. Revitalizing the Work Force/Skill Retention. a. A wide variety of opinion exists on this subject. At one extreme, the knowledge, skill and corporate memory vested in the current work force is regarded as a vital national asset to be carefully preserved. Others believe that the initiative and innovative spirit of the typical member of the current armament development community has been constrained by a restrictive, bureaucratic management system, and that he cannot respond to a new management philosophy emphasizing removal of barriers and output orientation. The latter group believes that recruitment is the only means of revitalizing the work force.

b. Ideally, revitalization and skill retention are not mutually exclusive. The greater emphasis on and visibility of development resulting from establishing the ADC will aid in increasing the productivity of the skilled workforce retained from the current population.

c. Through aggressive selective recruiting, coupled with a solid internal apprentice and training program, the new blood continuously added to the ADC staff can be productive quickly and be of immediate assistance in insuring continuity in armament development and support of improvement of fielded items.

3. Community Attractiveness. The attractiveness of communities in the vicinity of ADC sites affects the likelihood of relocation of the current work force, the success of recruiting efforts, and the morale of the ADC population. Job satisfaction should be primary but the life style available to the work force is also important.

Generally, sites meeting area and environmental criteria for armament development are not available in the most desirable locations. Some community characteristics, such as adequate housing and schools, are of interest to everyone. Beyond these, tastes vary, but highly educated professional personnel are likely to feel strongly about cultural aspects of the community. The availability of high quality educational institutions and the proximity of other research activities are important to the organization as well as to individuals.

4. Transfer/Recruitment/Turbulence. a. The personnel turbulence (relocation, separation and recruitment) anticipated as a result of the ADC reorganization concepts are summarized at Figure III-10. The methodology underlying these estimates is described in paragraph A-3 above and in greater detail in Annex III-B, Volume 3. Depending on the alternative, up to three-fourths of the current work force may be employed in the new ADC. The amount of inconvenience and hardship will be decreased by decisions to retire and by normal attrition. There is a direct trade-off between the number of personnel who may be separated by reduction in force (RIF) actions and the personnel who find employment in other government agencies (OGA). Although OGA opportunity may vary depending on the locality, the overall result is expected to be similar to that for previous reorganizations, which averaged about 30% of the total work force. The estimates in Figure III-10 reflect this experience. A separate attempt was made to identify a unique OGA factor for each location under consideration. It was recognized that some locations may have better employment opportunities with other government agencies than do others. However, in the data reviewed, the availability of federal employment could not be isolated sufficiently to quantify the results. In addition, the effects of several other economic factors such as unemployment or a hiring freeze could not be predicted. As may be expected, the Ft. Irwin alternative involves the highest personnel turbulence and conversely utilizes the least personnel from the current work force. The three-site alternative with the headquarters at Rock Island Arsenal produces the least personnel turbulence and the lowest number of RIFs and recruitments.

b. The estimate of personnel turbulence in Figure III-10 includes only the development population within the armament community. A corresponding estimate of turbulence in the remainder of the community caused by actions consequent to each ADC alternative were made as a part of the substudy reported in Volume 4. The two estimates are additive as a prediction of total turbulence in the armament community.

S U M M A R Y

PERSONNEL DISTRIBUTION AND TURBULENCE

PERSONNEL CATEGORIES	ALTERNATIVE 1	2	3	3a	4	5	5a	5b	6	7	8
A. Current Base Line (People)	10542	10542	10542	10542	10542	10542	10542	10542	10542	10542	10542
B. Proposed ADC (Spaces)	-	6386	6386	6386	6948	8083	7817	7996	8291	8291	8291
C. Reduction	N/A	4156	4156	4156	3594	2459	2725	2546	2251	2251	2251
A. Current Base Line Turbulence											
Transfer to ADC	N/A	3114	5488	6221	6528	7184	6945	7365	7753	7741	7741
Place OGA: Local	N/A	1672	1137	973	903	756	810	715	627	631	631
Relocate	N/A	1114	758	648	602	503	539	476	418	420	420
Attrition	N/A	1392	632	540	502	420	449	397	350	350	350
Retire	N/A	1392	632	540	502	420	450	398	349	349	349
Separate RIF	N/A	1858	1895	1620	1505	1259	1349	1191	1045	1051	1051
TOTAL	N/A	10542	10542	10542	10542	10542	10542	10542	10542	10542	10542
B. Proposed ADC Personnel											
Transfer (In-Place)	N/A	1392	2383	4597	4279	4977	5571	5158	5375	5419	5419
Transfer (Relocate)	N/A	1722	3105	1624	2249	2207	1374	2207	2378	2322	2322
New Recruitment	N/A	3272	898	165	420	899	872	631	538	550	550
TOTAL		6386	6386	6386	6948	8083	7817	7996	8291	8291	8291

Figure III-10

SECTION C: Operational Considerations.

INTRODUCTION

The purpose of this section is to evaluate the alternatives based on operational considerations. These considerations have been grouped into four categories: internal interfaces, flexibility of the work force, external interfaces, and degree of "fresh start" (and continuity of operations). Specific sub-elements comprising these categories are described in the appropriate section; all derive from the areas needing improvement in the current system (Chapter I) and from the ADC objectives and concepts (Chapter II). A qualitative rating is assigned each alternative based on a scale that includes the grades of "Excellent", "Good", "Fair", and "Poor". The base, or status quo, is considered "Poor" in each of the categories. Figure III-11 is a chart displaying in summary form the rating of the alternatives. It is recommended that Figure III-11 located at the end of this section be referenced while reading.

1. Internal Interfaces. a. Top Management and Work Force. The ADC top management should be located with the bulk of the systems development activities. How well the concept succeeds in achieving the primary objective of improving the armament development and materiel acquisition processes depends ultimately on the skills and attitude of the work force. Top management plays a major role in maintaining the requisite level of skills and the proper attitude by "managing," e.g., setting the tone, keeping the work force informed, supporting subordinates, managing resources, breaking barriers, relieving frustrations, and taking corrective action. The organizational concept and the consolidation make it easier for top management to communicate on a face-to-face and daily basis with the performing elements. This type communication permits changes in the way of doing business to be introduced with a direct explanation of their intent. Feedback can also be obtained on how well changes are being accepted for any necessary follow up action. In addition, major staff elements of the headquarters and other supporting elements that assist both the work force and management are more effective and efficient if they are not split. This is particularly true with the Systems Evaluation Office (SEO), Armament Concepts Office (ACO), Plans Office (PO), and Product Assurance Directorate (PAD). (An alternative is to collocate the top management of the ADC with the ALC irrespective of the location of the ADC population. However, it is believed the ADC Headquarters should be with the bulk of the development population.)

b. Integrated Systems Management. The three hardware development laboratories provide organizationally for a "systems approach." All the elements of each system laboratory's elements are collocated in all alternatives except Alternative 5B.

c. Technology Coupling with the Development. The basic organization provides most of the required expertise supporting technologies within each of the three material development laboratories, but all will receive ballistics technology from the Ballistics Research Laboratory (BRL and the Small Caliber Systems receive explosives and propellant technology support from the Large Caliber Laboratory). The alternatives vary in the degree in which they geographically assist or hinder the coupling of ballistics and explosives with development.

d. Technology Interchange. There should be a constant flow of technical information between the Small Caliber and Large Caliber Laboratories in the areas of fire control, fuzes, munitions, and other common technologies. Some alternatives facilitate this interchange through collocation of the Large and Small Caliber Laboratories which permits housing common disciplines together; other alternatives do not permit this spatial bond.

e. Availability of Firing Ranges. Both technological and developmental experimentation will be more efficient if live firing ranges are readily available. All alternatives include collocated firing ranges but the alternatives differ markedly in the length and capability of ranges available.

f. Evaluation for Internal Interfaces.

(1) One-Site Alternatives. All the one-site alternatives, 2, 3, and 3A, are rated in the "Excellent" category because the ADC Headquarters is with the laboratories and single (rather than split) offices are established for the SEO, ACO, PO, and Product Assurance Directorate. All systems are geographically collocated and both ballistics and explosives technologies are collocated with weapon systems development laboratories. The opportunity for interchanges within the technology areas such as fire control, fuzes, and munitions is excellent because the Large and Small Caliber Laboratories are collocated. Fort Irwin would provide the best long range artillery firing area, Aberdeen next best (ranges beyond 16 km, over water; and beyond 27 km, off the reservation), and Picatinny the least because only direct butt firing is possible with artillery. Although a single-site is defined as one including the headquarters and the Ballistics and Large and Small Caliber Laboratories (since the Chemical Laboratory is not to move), Aberdeen is rated "Excellent +" because it is with the Chemical Laboratory.

(2) Two-Site Alternatives. Alternatives 4 and 5 are rated "Good -." Although management is with three of the four laboratories, it is not with the bulk of the hardware development effort in the Large Caliber Weapon Systems Laboratory. The SEO, ACO, PO, and Product Assurance Directorate would also have to be split. All

systems are together and the Small Caliber Laboratory is with the Ballistics Research Laboratory; however, the Large and Small Caliber Weapon Systems Laboratories are split geographically, inhibiting interactions between the separated technology areas of fire control, fuzes, munitions, and weapons. Facilities for long range firing are located with the Small Caliber Systems, but not with the Large. Alternative 5A is rated "Good +" because management is with the bulk of the hardware development activity (both the Large and Small Caliber Laboratories); all systems are together geographically; explosives technology is with the weapons laboratories; and all fire control, fuzes, munitions, and weapons personnel are collocated. However, ballistics technology is geographically distant, and a long-range firing facility is not collocated with the Weapon Systems Laboratories. Alternative 5B is rated only "Fair +" because of the serious disadvantage of having "guns and bullets" geographically split between Aberdeen and Picatinny. Top management is with all four laboratory headquarters but not with the big business of ammunition development. Split offices would also be necessary for the SEO, ACO, PO, and Product Assurance. Explosives and propellants technology would be with the ammunition and not the weapons; and ballistics with the weapons and not the ammunition. Interchange within the technology areas of fire control, etc., should be very good. Ranges for long-range test firing would not be collocated with ammunition development.

(3) Three-Site Alternatives. These alternatives, 6, 7, and 8, are rated only "Fair" since management is never with both of the weapon system development laboratories, and split offices would be required for SEO, ACO, PO, and Product Assurance. Systems are together but both weapons laboratories are removed from ballistics technology and the Small Caliber Laboratory from explosives and propellants technology. Separation of the two weapons laboratories impairs technology interchange within the areas of fire control, fuzes, munitions, and weapons. Neither of the weapon systems laboratories is located with a long range test firing capability.

2. Flexibility of the Work Force. a. Explanation. If all personnel in the center working within a specific technology area, such as fire control or munitions, are at a single location rather than dispersed, there is a greater potential for shifting personnel to meet changes in workload, revitalizing an ailing activity, or "cross-fertilizing" the laboratories. If these personnel are also located with others working in supporting or related technological disciplines, the flexibility is even greater. This massing also provides more job and promotional opportunities for the work force and a wider field from which management can select outstanding performers. Also, the larger grouping permits economies in the size and content of the work force. The dispersion of personnel, as in some alternatives, degrades flexibility and reduces potential economies; but, in all cases, the situation is better than it is currently.

b. Evaluation for Flexibility of the Work Force.

(1) One-Site Alternatives. All these alternatives, 2, 3, and 3A, are rated in the "Excellent" category because collocation does provide maximum flexibility. Alternative 3 is rated "Excellent +" because of the inclusion of the Chemical Systems Laboratory for a totally collocated ADC.

(2) Two-Site Alternatives. Alternatives 4 and 5 are rated "Good" primarily because the separation of the Large and Small Caliber Weapon Systems Laboratories degrades flexibility to shift fire control and other common expertise across laboratory boundaries. The Small Caliber Laboratory being collocated with the Ballistics Laboratory provides some flexibility between the two. Alternative 5A is rated "Excellent -" because the two weapon systems laboratories are collocated providing very good flexibility in the disciplines of fire control, fuzes, munitions, and weapons. Alternative 5B is rated "Good +" because similar disciplines in fire control, fuzes, munitions, and weapons are all collocated even though the weapon system laboratories are geographically split. Flexibility within a single weapons laboratory is reduced by the split, but flexibility between the Ballistics Laboratory and the collocated portion of the weapons laboratories is enhanced.

(3) Three-Site Alternatives. Alternatives 6, 7, and 8 separate the Large and Small Caliber Weapon Systems Laboratories from each other and from the Ballistics Research Laboratory severely degrading flexibility in use of the work force. All these alternatives are rated only "Fair."

3. External Interfaces. Principal external organizations with whom the ADC interacts include the Armament Logistics Command, the user, AMC Commodity Command and other Service customers, AMC Headquarters, other AMC laboratories, and the private sector.

a. ALC. The interface between the ADC and ALC will primarily involve the three materiel development laboratories, the Large and Small Caliber Weapons and the Chemical Systems Laboratories. The ALC will have a resident contingent with the development laboratories for integrated logistic support(ILS) planning. There will also be close ADC/ALC interfaces in the operation of joint configuration control boards, in the joint planning of procurement strategy, and in the provision of engineering support to follow-on production. Other aspects such as maintenance evaluation, malfunction investigation, and stockpile reliability problems will all require close and frequent contacts between the ALC and the development laboratories. This interaction is eased and made more efficient with increasing laboratory collocation.

b. User. The user's representatives, normally the combat

development element of the TRADOC schools, and to a lesser extent the users themselves will all interact with the ADC. In general, the interface between the user and the ADC is simplified and improved with increasing collocation of laboratories. Expected principal interactions of weapon systems laboratories with TRADOC schools are shown below:

TRADOC School	Laboratory
Infantry	Large and Small Caliber
Armor	Large and Small Caliber
Field Artillery	Large Caliber
Air Defense	Large and Small Caliber
Engineers	Large Caliber
Army Aviation	Large and Small Caliber

All would interact to a lesser degree also with the Chemical Systems Laboratory for either offensive or defensive systems.

c. AMC Commodity Command and Other Service Customers. The primary ADC customers are AVSCOM and TACOM who would look to the ADC for weapon systems for aerial and surface vehicles. MICOM would contract with the ADC for rocket and missile warhead sections. Other Services would also be customers of the ADC. The ADC laboratories with whom these commands and the Services would do business are shown below:

Customer	Laboratory
AVSCOM	Large and Small Caliber
TACOM	Large and Small Caliber
MICOM	Large Caliber
USMC	Large and Small Caliber
USN	Large and Small Caliber
USAF	Small Caliber

All these customers would also interact with the Chemical Systems Laboratory to some degree. Collocation of the ADC laboratories would improve these interactions.

d. AMC Headquarters. The expected frequent informal contacts with AMC Headquarters as well as the formal actions, reviews, studies, and correspondence would be enhanced with increasing collocation of the ADC elements.

e. Other AMC Laboratories. The ADC will require technology and technical assistance from the Harry Diamond Laboratory, Night Vision Laboratory, Target Acquisition and Battlefield Surveillance Laboratory, MICOM RD&E Laboratory, Human Engineering Laboratory,

Army Materiel Systems Analysis Activity, and the Army Materiels and Mechanics Research Center. Most of these activities are located in the northeastern United States. These interactions would be eased by location of the ADC laboratories in the northeastern United States, but this is not a major consideration.

f. The Private Sector. For interactions with industry or academe, collocation of laboratories and the ADC Headquarters would be a convenience but is not an overriding consideration in choosing among the alternatives.

g. Evaluation of External Interfaces.

(1) One-Site Alternatives. All the one-site alternatives, 2, 3, and 3A, fall in the "Excellent" category because collocation of the ADC elements provides the simplest, most economical, and most effective interface with external agencies. The Aberdeen alternative 3, is rated "Excellent +" because the Chemical Systems Laboratory is with the ADC.

(2) Two-Site Alternatives. Alternatives 4 and 5 are rated "Good +". Entire weapons systems are together at a single installation and the Small Caliber and Chemical Systems Laboratories are together. The Large Caliber Laboratories are separated from the Small Caliber Laboratories and the ADC Headquarters, thus increasing the problem of the many external agencies who deal with both Large and Small Caliber Laboratories. Alternative 5A is rated "Excellent -" since both the Large and Small Caliber Weapon Systems Laboratories and the ADC Headquarters are all collocated. This alternative closely approaches the single-sites in ease and efficiency of dealing with external agencies; only the less frequent external interactions involving the Chemical Systems and Ballistics Research Laboratories detract from the excellence of this alternative. Alternative 5B is also rated "Excellent -" but for different reasons. The ADC Headquarters and all four laboratory headquarters are collocated at Aberdeen simplifying and easing external interfaces; however, the separation of munitions and fuzes at Picatinny detracts from the excellence of this alternative since many of the external interfaces critically involve the munitions aspects of weapon systems.

(3) Three-Site Alternatives. All three-site alternatives, 6, 7, and 8, rate only in the "Fair" category because of the geographic fragmentation of the ADC elements. The Large and Small Caliber Weapon Systems Laboratories are separated from each other and from the Chemical Systems Laboratory (and Ballistic Research Laboratory) with the ADC Headquarters with either the Large or Small Caliber Laboratory. Alternative 6 is rated "Fair +" because of the enhanced interface with the ALC. Although fragmented, these alternatives do make the interactions easier for the external agencies then they are today.

4. A Fresh Start. As discussed in the concept of operations (Chapter II), the ADC must be established in both substance and appearance as more than just a "stirring of the personnel pot" and "rearranging of organizational blocks."

a. New Personnel. The concept is designed to assist in revitalizing the work force and introducing a new way of doing business. It will take new leadership, enough new people to spark the acceptance of new ways, new teams, new attitudes of "thinking systems development," and, finally, the nurturing of pride in the development (or improvement) of an entire armament system--not just a round of ammunition, a new fire control device, or a new fuze. There is no single correct answer on the percent of new people needed, but it is certain some are essential, especially key leaders. Since the formation of the ADC involves a consolidation (rather than expansion), increasing numbers of recruits imply a corresponding increase in risk of losing current expertise and corporate memory, and a consequent degradation in ability to continue operations. The balance between the number of people needed for a fresh start and those skilled "old-timers" with the needed memory retained to insure continuity of operations is a judgement call.

b. New Activity and Facilities. Building a new development activity where none exists now is perceived as more of a fresh start than adding to an existing development activity. The nature and quality of the facilities to be occupied by the activity also affect the perception.

c. Evaluation of "Fresh Start."

(1) One-Site Alternatives. All single-site alternatives rate high for "fresh start" because of the dramatic change from the status quo. Among these alternatives, Fort Irwin (Alternative 2) is the only revolutionary, new, completely "fresh start" offered. It is in a category apart from the others in magnitude of change, both in people and facilities. It is rated "Excellent +." It requires 51% new recruitment which carries with it the greatest risk of loss of skills and continuity of operations. Aberdeen (Alternative 3) involves 14% new hires and enjoys an "Excellent" image of "fresh start" since development activities would be moving to a site where only a technology activity exists now; but, again, the turbulence and risk of loss of continuity of operations is very high. Picatinny (Alternative 3A) involves somewhat less desirable renovated facilities and carries a somewhat less than excellent image of a fresh start because of the very large development population now there, and the estimate of only 3% new hires. Correspondingly, this alternative is rated "Good."

(2) Two-Site Alternatives. Two-site alternatives are mainly

in the "Good" category because they provide considerable change over the status quo. Alternatives 4 and 5 are judged "Good +" because of the location of the Small Caliber Weapons Systems Laboratory, a new development activity, at Aberdeen where none exists now. New hires range from 6 to 11% for the two alternatives. Alternative 5A (11% new hires) is judged "Good -" with respect to fresh start since it builds both weapons development laboratories on the development activities at Picatinny with its large local population; yet it consolidates the vast bulk of the hardware development with the ADC Headquarters and, depending on leadership, could rapidly develop a well-founded image of newness. Alternative 5B (8% new hires) is judged "Good" because the weapons and fire control portions of the weapons laboratories are built up with the technology activity at Aberdeen, but the munitions and fuze portions will be essentially the present activity--slimmed down--at Picatinny. All four laboratory headquarters at Aberdeen in 5B helps create an impression of fresh start.

(3) Three-Site Alternatives. Three-Site alternatives 6, 7, and 8 are all rated in the "Fair" category because they provide much less change from the status quo than the one or two-site alternatives. Alternative 6 distinctly lacks the image of fresh start with the Small Caliber Laboratory built on Rock Island and the Large Caliber Laboratory on Picatinny; the retention of the development headquarters at Rock Island further detracts from the image of newness. Alternatives 7 and 8 suffer the same image problems as 6, although new facilities in Alternative 7 would improve the image and hence its rating is "Fair +."

SATISFACTION OF OPERATIONAL CONSIDERATIONS BY ALTERNATIVE

CHARACTERISTICS / RANKING		INTERNAL INTERFACES	WORKFORCE FLEXIBILITY	EXTERNAL INTERFACES	"FRESH START"
EXCELLENT +		(3)	(3)	(3)	(2)
EXCELLENT		(2) (3A)	(2) (3A)	(2) (3A)	(3)
EXCELLENT -			(5A)	(5A) (5B)	
GOOD +		(5A)	(5B)	(4,5)	(4,5)
GOOD			(4,5)		(3A) (5B)
GOOD -		(4,5)			(5A)
FAIR +		(5B)		(6)	(7)
FAIR		(6) (7,8)	(6) (7,8)	(7,8)	(6) (8)
POOR		(1)	(1)	(1)	

KEY TO ALTERNATIVES[a/]

BASE	(1)	
ONE-SITE	(2)	Fort Irwin
	(3)	APG
	(3A)	PA
TWO-SITE	(4)	APG (Small Cal Sys, Ballistics) - PA (Large Cal Sys)
	(5)	APG " PA "
	(5A)	APG (Ballistics) - PA (Large & Small Cal Sys),
	(5B)	APG (Large & Small Cal Sys, Ballistics) - PA (Large & Small Cal Munition Subsys)
THREE-SITE	(6)	APG (Ballistics) - PA (Large Cal Sys) - RIA (Small Cal Sys)
	(7)	APG " - PA " - FA (New) "
	(8)	APG " - PA " - FA (Old) "

a/ Chemical Systems Laboratory remains in place at APG (Edgewood).

Figure III-11

SECTION D. Community Economic Impact Statements.

The economic impact on the affected communities is contingent upon the number of personnel affected at each installation, the total number of governmental employees in the local area and the number of personnel within the adjacent metropolitan area. Community economic impact statements on the five areas affected by the various alternatives of the study have been prepared by the Office of Economic Adjustment, Office of the Assistant Secretary of Defense (Installation and Logistics). These statements are preliminary in nature. They include descriptions of economic conditions in each area and generalized assessments of the impact of assumed representative reductions in the local armament development populations. Detailed community statements will be required when an alternative is selected for implementation. The complete texts of the community economic impact statements are included as Annex III-E, Volume 3. The specific numbers of personnel affected by installation by alternative can be found in Annex III-B, Volume 3. A brief summary follows:

1. Picatinny Arsenal - The local community at this site is currently in an economic slump, precipitated to some degree by past DoD actions at the Arsenal. Unemployment is significantly higher than the national average. Proposed reductions being considered would further aggravate this situation; however, the impact could be lessened by phasing down over a period of time, and accelerating retirements of those who are currently eligible.

2. Frankford Arsenal - The metropolitan Philadelphia area is one of the major industrial centers of the United States. However, its current economic activity is shifting away from manufacturing; and the city has a low median income and relatively high unemployment. The potential loss to the community could be moderately significant, depending on possible reuse of the site and facilities by the private industrial sector.

3. Aberdeen Proving Grounds - The economic health of the local community at this site is reasonably good. However, the total impact of this action should be considered in light of other potential DoD actions. The immediate vicinity is characterized as being overly dependent upon a military-based civilian population which could suffer a moderate disruption. This action could be offset by the general expansion of the Baltimore-Washington development corridor.

4. Watervliet Arsenal - The local community is both highly industrialized and relatively strong, with unemployment somewhat below the national average. The economic base is diverse and, as such,

is able to absorb potential reductions. Hence, the impact of the action on the total area is not expected to be significant.

5. Rock Island Arsenal - The local community at this site is currently strong, characterized by low unemployment and continued economic growth. Manufacturing is predominant in the immediate vicinity, and agriculture in the surrounding area, and could partially absorb any reductions. In addition, any impact would be lessened by a gradual phase-down. Thus, the total impact is considered to be minimal.

SECTION E. Delphi Benefit Analysis

1. Introduction.

The assessment and comparison of the relative benefits of the various alternatives was one of the most important and most difficult aspects of the study. Precise evaluation was not possible. The Delphi procedure described in this section was conducted to obtain the collective opinion of a group of individuals knowledgeable of armament research and development. Approximately forty participants, most of whom were not involved in the study, were included in the Delphi iterations. The results of this effort provided helpful insight on the largely unquantifiable benefits, how they might be weighed with respect to each other, and how they might vary among a set of alternatives representative of the actual study alternatives.

2. Method. a. There is always a strong mandate for benefit analysis; but it is most critical in analyses, such as this one, where benefits display significant variation among alternatives. An unequal benefit analysis requires enough benefit determination to quantify output or, at a minimum, enough knowledge of output to be able to rank the alternatives.

b. The output of a development community is difficult to measure. The AMARC study criticized the armament development community for the paucity of new weapons, for resistance in accepting externally developed (not invented here) concepts, and for investment in some notable failures. Obviously a greater number of successful new developments, a greater degree of useful innovation, a much smaller number of unsuccessful or unneeded weaponry projects comprise the objective; but measures of output for year-to-year or day-to-day use cannot be specified. A compilation of technical data packages produced or maintained, or of pages of manuals written, would not meet the requirement.

c. The AMARC study contains several narrative attributes or descriptors of the type of development community which could be expected to achieve the desired objectives. By using these narrative attributes as intermediary benefits (outputs), a composite output can be established. Expert opinion was needed to insure that the list of narrative benefits was complete and valid. A modified Delphi procedure was planned to use group judgment not only for the establishment of narrative benefits but also for the establishment of relative values of each benefit and the forecasting of how well each generic alternative would accomplish each narrative benefit.

d. The first task of the procedure was to list and define the benefits. For example, two narrative benefits occur frequently in

the AMARC study. These are "Collocation of Specialists" and "Attract Talent." These two were included in a group of fifteen and were provided with brief narrative descriptions for the first Delphi iteration. During the first two iterations, the list of benefits was reduced to ten and overlap was eliminated. The ten benefits and their descriptions are provided by paragraph 4, below. After the second iteration, the benefits and their descriptions were standardized and were no longer subject to modification by the participants.

e. The second task was to establish relative weights for each benefit. The first narrative benefit, "Collocation of Specialists," was used as a standard and awarded a weight of 100 points. The panel was asked to judge the value of all other benefits in relation to the standard and to assign appropriate weight to them. By determining the median of the responses from the panel, a quantified relative value for each narrative benefit was established. The compilation of all benefits and their relative weights represent the model or ideal output of an armament development community.

f. The third task accomplished by the modified Delphi process was to forecast the accomplishment of each narrative benefit by each alternative. For example, if 200 relative weighing points were assigned to the benefit "Attract Talent" and the participants forecast a 50 percent realization of this benefit in an alternative, the points awarded the alternative for "Attract Talent" would be 100.

g. In developing this methodology for the Delphi procedure, the advice and recommendations of the US Army Materiel Systems Analysis Activity and of Professor Normal Dalkey of the RAND Corporation were used. Because of the long lead time required for the Delphi technique, five representative alternatives were used instead of the complete listing of alternative courses of action eventually developed and described in detail in Chapter II, above.

3. Assumptions. a. That the five generic alternatives described in paragraph 5 below, cover the range of choice sufficiently to permit application of the results of the procedure in the overall evaluation and comparison of actual alternatives.

b. That the results of four iterations of the Delphi procedure validly forecast the output of the ideal development center and of the alternatives described in paragraph 5, below.

4. Benefit Descriptions. Provided below are the ten benefits and their descriptions established by the first two iterations and distributed to the panel. In some instances, rhetorical questions were provided for clarity.

a. Collocation of Specialists.

Collocation of scientific, engineering, technical and support personnel will permit better coordination and interaction of those activities. Collocation will also permit economies in the size of the force required and permit the elimination of undesirable redundancies. Furthermore, greater selectivity in choosing project team members and a broader base of selection for advancement of qualified personnel is provided.

(1) Is the ADC HQ located with the mass of the ADC?

(2) Is the ADC HQ located near EA and BRL?

(3) Is the AMARC goal of collocation achieved?

(4) Are the technology and the development organization split?

b. Command/Management Attention.

A command/management group which is insulated from supply, maintenance, and production problems will concentrate on R&D and be better able to respond to problems and fully participate in program assessments.

Has the administration of the ARMCOM RDTE effort been simplified?

c. Attract and Foster Talent.

A new development center, reorganized and revitalized, will attract and foster talent. The development center, oriented toward advanced technologies, will create and maintain a strong technological base.

(1) Would the facilities and location be attractive to professionals?

(2) Would easy access to and cooperation with universities be achievable?

(3) Would the mission and organization of the development center attract and stimulate talented professionals?

d. Optimize Use of Existing Work Force.

Implementation of the alternative will create minimum impact on personnel and programs. It will serve to retain current expertise and talent.

(1) Do the site(s) and organization simplify recruitment from the existing work force?

(2) Is the transition of personnel from present posture to the ADC steady state posture facilitated?

e. Systems Management.

The organization should facilitate the systems approach. Systems approach is an ordered method that assures that the components of a weapons system are developed in relation to one another and that all fit and function to achieve the desired Required Operational Capability. Provisions should be made for interface with the armament logistical element to insure complete consideration of alternatives.

(1) Do the organization and location of the development center facilitate and support the development of materiel systems as opposed to components?

(2) Are weapons and related munitions collocated?

f. Identification of Return on Investment.

The development center organization will facilitate the isolation and identification of output and of resources consumed in the production of that output.

g. Increase Flexibility of Response to Fluctuating Funds/ Workloads.

The centralized location of personnel facilitates adjustment of personnel resources to changes in workload, to delays in fund release, and to changes in major program thrusts. The organization counteracts the inability to make timely adjustments in the content and size of the work force under current Civil Service regulations.

Is flexibility in the use of the work force encouraged by the degree of concentration?

h. Improve User Relationships.

The centralization of the RD&E community and the provision of specific organizational elements dedicated to user (TRADOC and major field commands) relationships should improve the effectiveness of the interface between developer and user.

i. Encourage New Concepts.

The ADC will encourage in-house innovation and openness to outside suggestions in development of new weapon concepts. Centralization coupled with an organizationally independent management will facilitate the exchange of information with out-of-house sources, such as private inventors, foreign technology, commercial laboratories, the academic world, etc.

j. Attractive Site Location.

The proposed site(s) are located near higher commands, centers of users, and provide for each operation.

(1) Is the location attractive to professionals?

(2) Does the ADC compete with other organizations for installation space, facilities, and services?

(3) Are adequate test ranges available in the locality?

(4) Are family housing, schools, and commercial centers readily available?

(5) Are commercial transportation terminals easily accessible?

5. Alternatives. Described below are the five generic alternatives used for the modified Delphi technique.

a. One-Site, Located at APG.

Collocate the Armament Development Center (ADC) with its required ancillary support at one location. For this analysis, Aberdeen Proving Ground, Aberdeen, Maryland, was selected as the site for the center. Edgewood Arsenal is located on Aberdeen Proving Ground and will retain its chemical/biological mission. The Harry Diamond Laboratory in Washington, DC, will not be moved; their work will be contracted by the ADC. This new center will report to the US Army Materiel Command.

b. One-Site, Located at Site X.

Collocate the Armament Development Center with its required ancillary support at one location not now occupied by subordinate activities of the US Army Armament Command. The proposed site, in southern California, consists of over 600,000 acres of US Army owned real estate which would be sufficient for building the required laboratories, supporting shops and test ranges for firing practically all size weapons. The site contains relatively new

support facilities such as 506 family quarters, commissary, post exchange, auditorium, theater, swimming pools, golf course, BOQ's, barracks, clubs and messes, bowling alley, hospital and an elementary school. There is limited community support within 50 miles. The local labor market is limited, but a professional and technical labor market exists within a 150 mile radius with a population of over 5 million. Interstate highways within the area are adequate. Edgewood Arsenal will not be moved from Aberdeen Proving Ground, but will retain its chemical/biological mission and report to the new center. The Harry Diamond Laboratory will not move; their work will be contracted by the ADC. The new center will report to the US Army Materiel Command.

c. Two-Site, Located at APG/PA.

Collocate the Armament Development Center with its required ancillary support at two separate locations. For purposes of analysis, Picatinny Arsenal, Dover, New Jersey, and the Aberdeen Proving Ground have been selected. Edgewood Arsenal will retain its chemical/biological mission and will not move. It will be operationally controlled by the new center. The Harry Diamond Laboratory will not move; their work will be contracted by the ADC. This center will report to the US Army Materiel Command.

d. Three-Site, Located at APG/PA/RIA.

Collocate the Armament Development Center with its required ancillary support at three separate locations. For purposes of analysis, Picatinny Arsenal (large caliber weapons), Aberdeen Proving Ground (BRL related technologies), and Rock Island Arsenal (Headquarters and small caliber weapons) have been selected. The possibility exists that the Philadelphia area will replace Rock Island Arsenal in this alternative. In this case, Headquarters will be at Picatinny Arsenal. Edgewood Arsenal will retain its chemical/biological mission and will not move. It will be operationally controlled by the new center. The Harry Diamond Laboratory will not move; their work will be contracted by the ADC. This center will report to the US Army Materiel Command.

e. Modified Status Quo.

Maintain the status quo with the exception of the creation of a new Armament Development Center Headquarters to be collocated at US Army Armament Command. The existing Research, Development and Engineering Directorate of this Command will be the nucleus of this new headquarters. All of the Armament laboratories will stay in place, but will be operationally controlled by the new headquarters except the Harry Diamond Laboratory.

6. Matrix. Provided on the next page is the matrix developed by taking the median of all replies, rounded to the nearest multiple of five. Each column of values was totaled for a rapid comparison of alternatives to the ideal weights.

7. Profiles. a. Time did not permit more than four iterations of the Delphi Technique. Further convergence upon the median and possible shift of the median may have resulted from additional iterations. However, such shifts of the median would not, in all likelihood, be significant.

b. The simplest way to rank the alternatives would be to establish a fraction consisting of the total value awarded to the alternative over the total weight of the ideal. For example, for the APG/PA/RIA alternative the fraction would be $\frac{910}{1380}$ or 66 percent accomplishment of the ideal.

c. Such a portrayal simplifies the ranking of alternatives but does not validly portray the output forecast for each alternative. A single percentage figure implies uniform accomplishment of each benefit. In fact, there are high and low points of accomplishment which may influence the decision maker. Furthermore, there is no valid way of portraying the range of response which reflects the agreement or disagreement of the panel on the accomplishment of the benefit by a particular alternative. Accordingly, a benefit profile was selected to portray the results of the modified Delphi technique. The profiles follow as Figures III-12 to 16.

MATRIX

	WEIGHT (Median)	ONE-SITE APG (Median)	ONE-SITE X (Median)	TWO-SITE APG/PA (Median)	THREE-SITE APG/PA/RIA (Median)	STATUS QUO (Median)
1. Collocation of Specialists (Standard)	100	100	100	75	50	30
2. Command/Management Attention	100	100	100	80	60	40
3. Attract and Foster Talent	200	160	135	150	135	135
4. Optimize Use of Existing Work Force	150	70	45	100	120	150
5. Systems Management	200	200	200	150	120	100
6. Identification of Return on Investment	80	80	80	65	55	40
7. Increase Flexibility of Response to Fluctuating Funds/Workloads	150	150	150	120	100	75
8. Improve User Relationships	150	150	150	120	100	80
9. Encourage New Concepts	150	150	150	120	100	75
10. Attractive Site Location	100	75	70	75	70	70
TOTAL	1380	1235	1180	1055	910	795

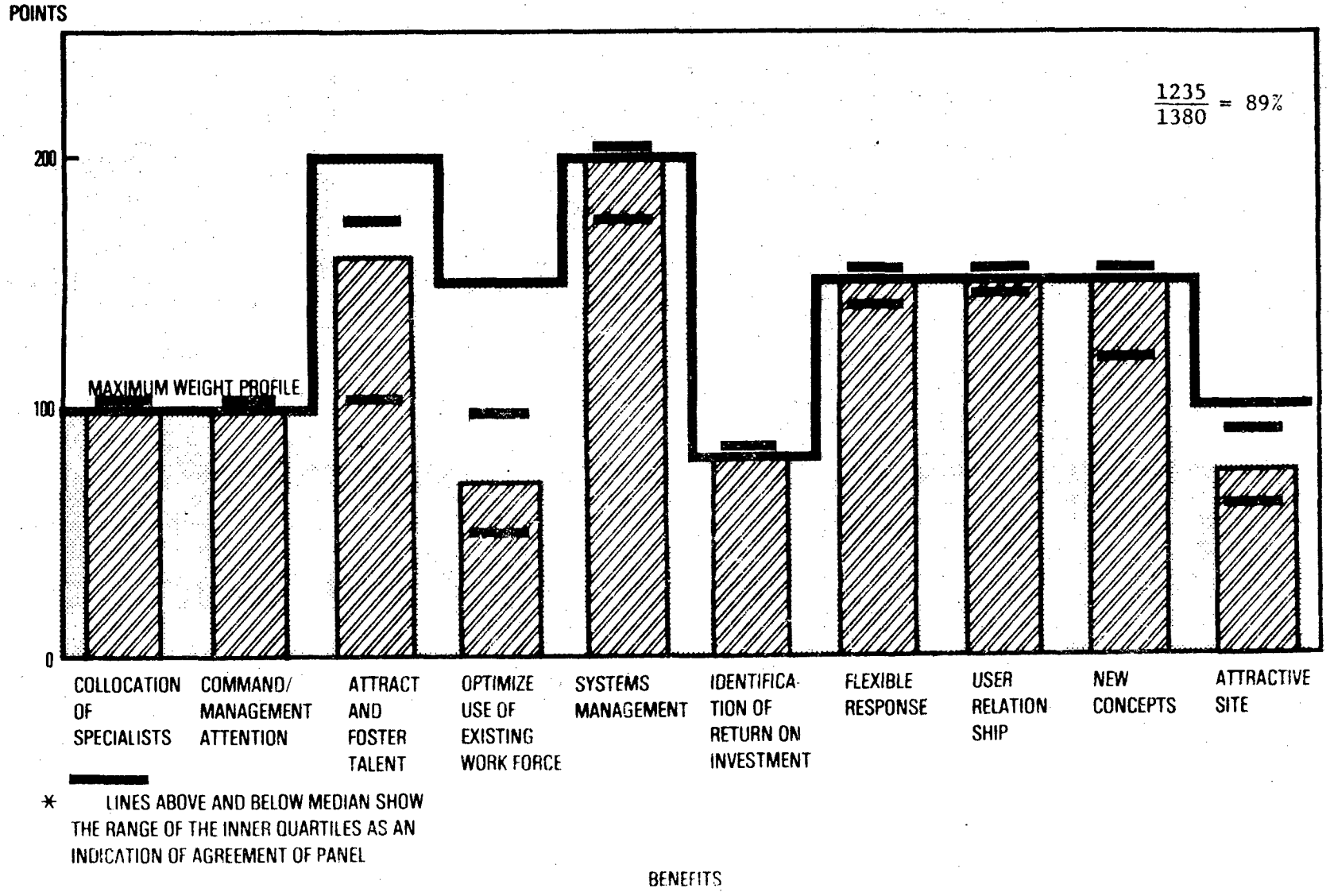


Figure III-12

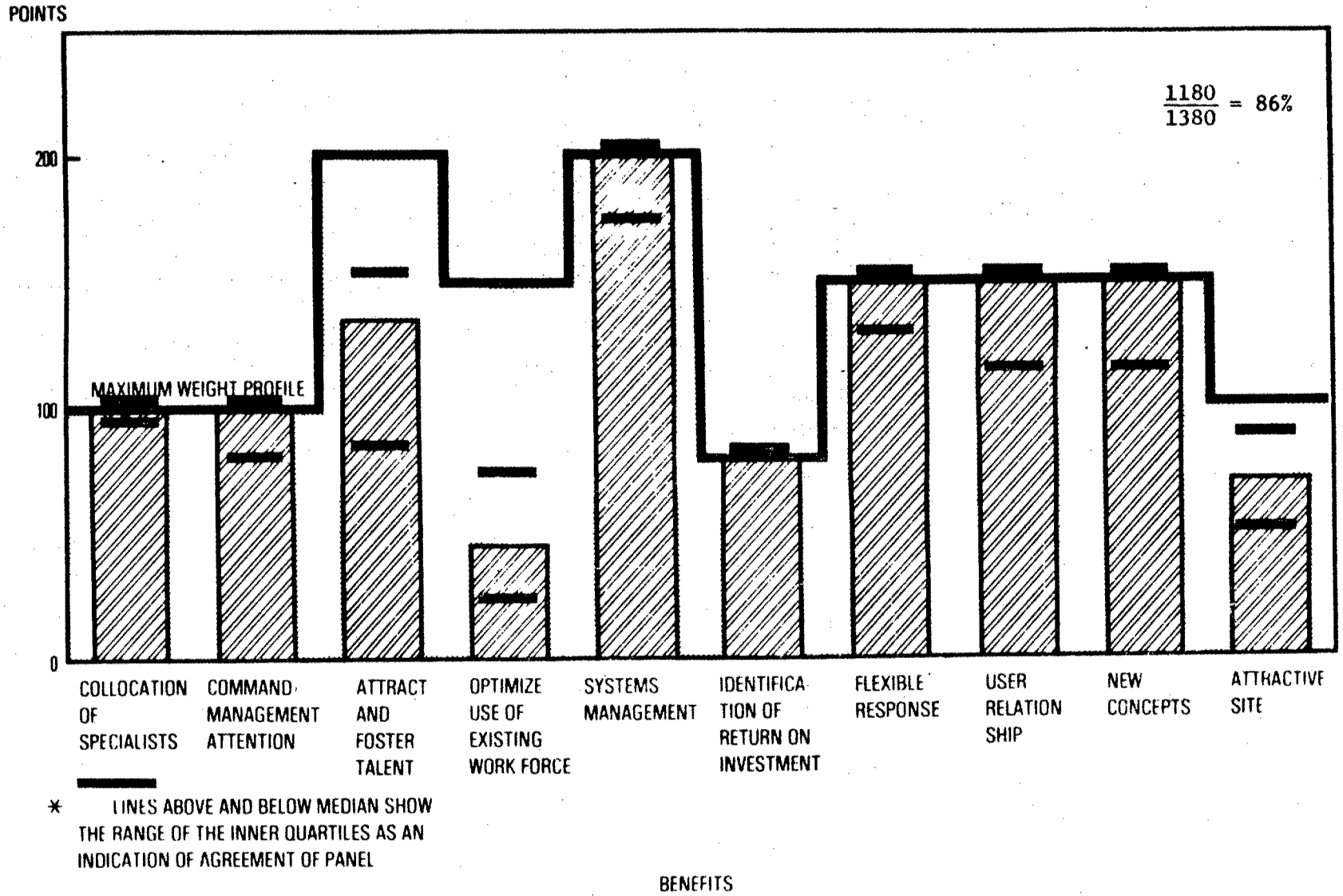


Figure III-13

TWO-SITE APG/PA

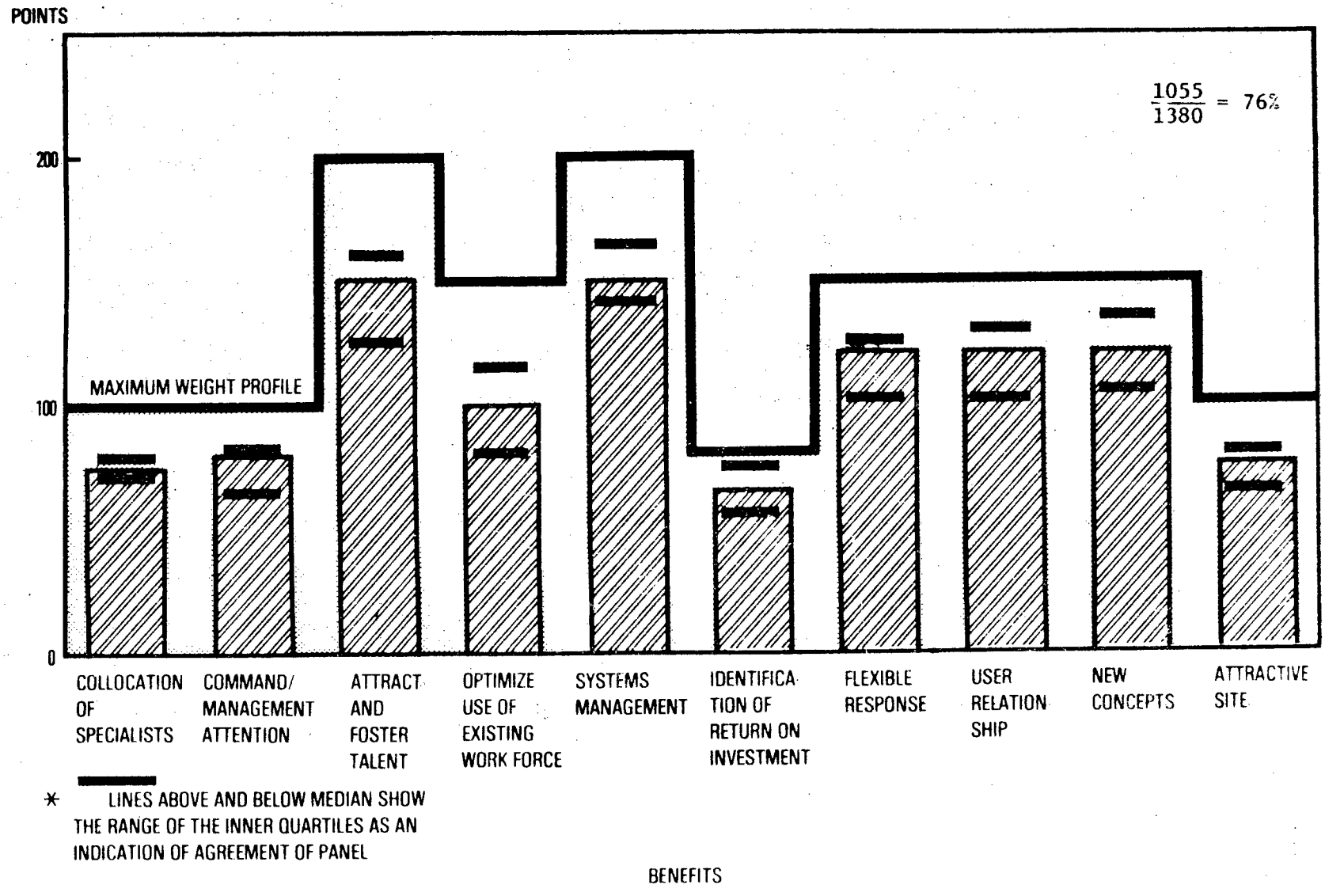


Figure III-14

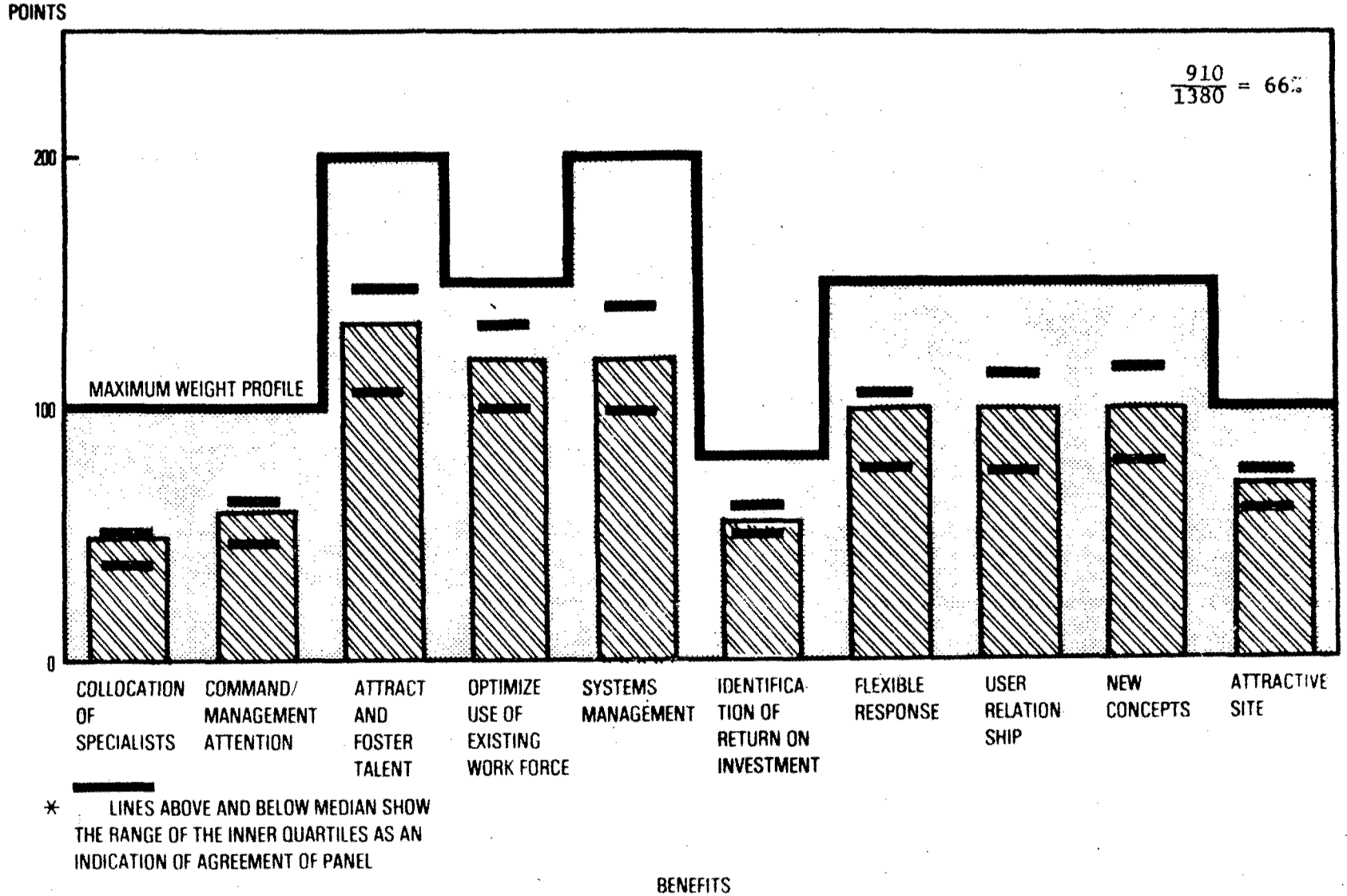


Figure III-15

STATUS QUO

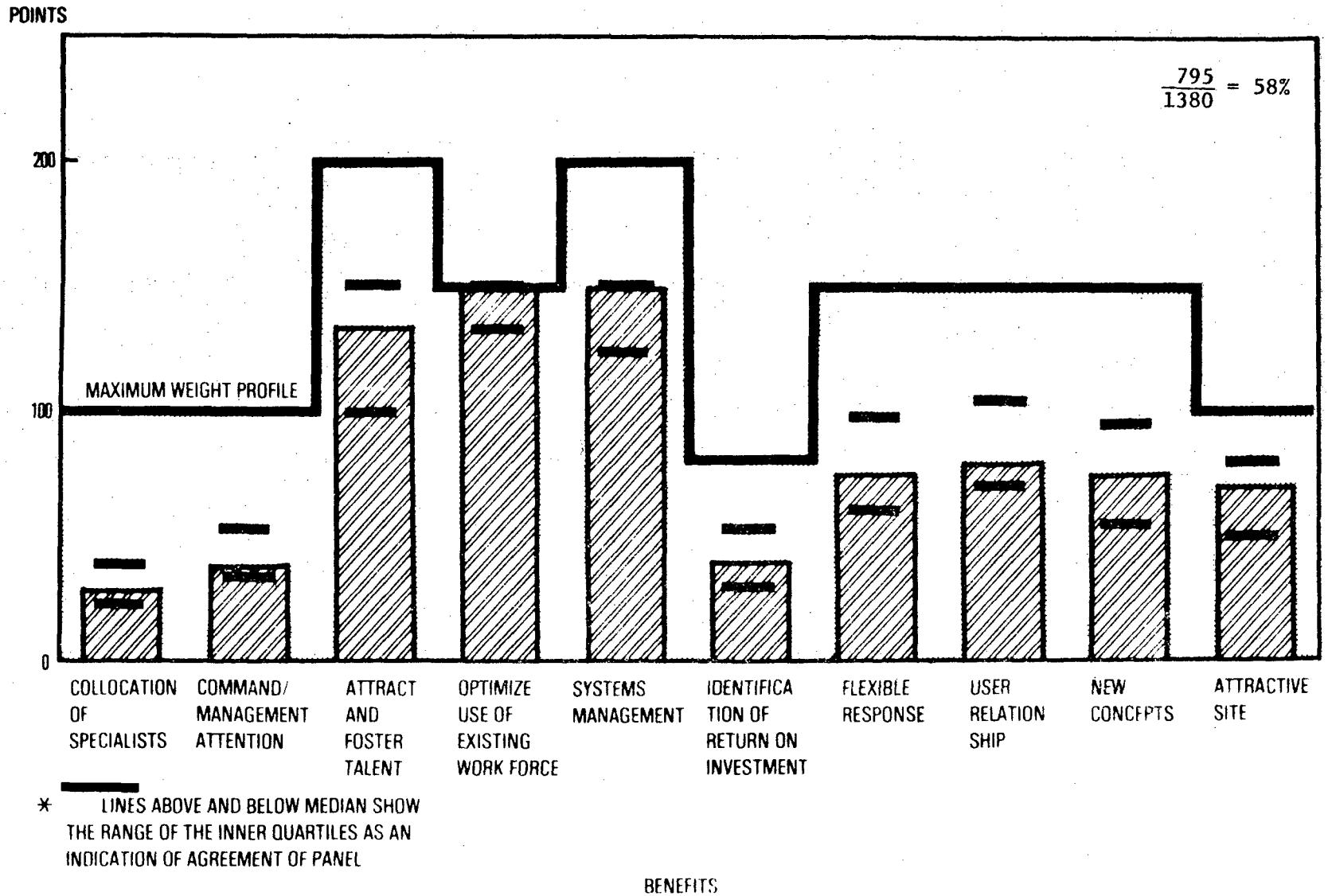


Figure III-16

SECTION F: Summary Evaluation and Comparison of Alternatives.

In the previous sections of this chapter, the ADC alternatives have been evaluated in detail with respect to operational considerations, personnel actions, costs, and economic impact on communities. In this section, the evaluations are grouped and summarized by alternative and the alternatives compared. Figures III-17 and III-18 provide summary tables at the end of this section.

1. One-Site Alternatives. a. Alternative 2. Fort Irwin is in a special category. It is the only alternative that provides for a completely new start, with completely new facilities and test ranges. Fifty-one percent of the population would be newly recruited from outside the present community. It requires the lowest operating costs; however, one-time costs are $287 million and this is more than twice that of any other alternative. Start of the transition to the new ADC would be delayed until FY 78 while awaiting new construction, and completion is not forecast until FY 84. The Chemical Systems Laboratory would have to operate as a semi-independent activity because of its separation. Extremely high investment costs, delayed implementation, severe personnel turbulence with serious potential loss of experts, potential loss of continuity of operations and very severe economic impact especially on the Picatinny community are all heavy disadvantages attached to this truly "fresh start" alternative.

b. Alternative 3. Aberdeen Proving Ground provides all the excellent operational advantages of total collocation; it is the only truly one-site alternative since the Chemical Systems Laboratory is on site. Should the Ordnance Center and School facilities become available, this alternative provides the next best facilities and ranges to Fort Irwin. One-time investment costs of $138 million are $60 million higher than the Picatinny single-site alternative (3A); the increase is due to the transfer cost of a large number of people and unique facilities from Picatinny. Annual recurring costs are $5 million higher than other one-site alternatives because of APG's relatively high overhead costs. The transition would be completed in FY 81. This alternative provides a base of expertise in BRL to assist in the transition of small arms and automatic cannon developments. The ADC would be collocated at APG with TECOM, AMSAA, the the Human Engineering Laboratory with all of whom it has a close technical relation. This alternative should provide an excellent "fresh start" and a very good image; the center would be built upon a relatively small population that is primarily involved in ballistics technology, and 14 percent of the ADC population would be recruited from outside the present community. With this recruitment level and the large number of transfers, there is a concommitant high risk to continuity of operations. Economic impact is severe -- only slightly less than the Fort Irwin alternative.

c. Alternative 3A. This alternative provides excellent operation conditions by consolidating at Picatinny all ADC activities except the Chemical Systems Laboratory and a small detachment at Aberdeen to maintain ranges and wind tunnels. The inherited large resident population and facilities permit continuity in the munitions and fuze programs during the transition and make the one-time investment costs ($78 million) lowest of the one-site alternatives. Annual recurring costs are lower than any alternative except Fort Irwin. This alternative would provide adequate facilities but of lower quality and less attractive than those at Aberdeen. At Picatinny, artillery and tank cannon can be fired into butts or a rail recovery system, but no long-range firing facilities are available; lone-range firing would have to be done at Aberdeen or Yuma. Two major disadvantages for a new ADC are the very large inherited resident population which detracts from a "fresh start", and the potential loss of BRL's ballistic expertise. With only three percent new recruitment estimated, extraordinary management effort will be required to introduce a new way of doing business. The transition would be completed in FY 81. Economic impact would be moderately large, but less severe than any other one-site alternative.

d. Comparison. The primary advantages and disadvantages of the one-site alternatives are summarized for comparison on the following page, in Figure III-19.

(1) Although Fort Irwin Alternative 2 would offer the freshest of the "fresh starts", it is not recommended because of the high investment cost, the very high personnel turbulence, the great risk of loss of armament development capability, the difficulty in maintaining program continuity, and the long delay in initiating and completing establishment of the ADC.

(2) The Aberdeen Alternative 3 is selected as one of the preferred alternatives. It achieves the highest degree of consolidation and collocation with all four laboratories at one location together with the needed firing ranges. It could be completed by FY 81 and would provide an excellent facility for many years. Although this alternative requires a high initial investment, it is still cost effective and achieves considerable savings over the status quo. It does require movement of the largest development contingent in the community, the munitions and fuze work at Picatinny, creating turbulence and a potentially severe loss of capability. The high costs and risks are recognized as is the fact that the risk can be reduced to an acceptable level by a carefully executed and well supported implementation plan. This alternative provides very great benefits for the long term.

(3) The Picatinny Alternative 3A is not recommended even though it is the least costly of any alternative and provides for almost

ONE-SITE ALTERNATIVES

	2 FORT IRWIN	3 ABERDEEN	3A PICATINNY
ADVANTAGES:	New start; 51% recruitment Completely new facilities Unlimited ranges	Complete consolidation Partial fresh start; new development activity; 14% recruitment Good quality facilities Arty range to 16km over land Complete in FY 81	Greatest skill retention Lowest costs Complete in FY 81
	Common to all: Excellent technology interchange and coupling with development Excellent work force flexibility		
DISADVANTAGES:	Transition start delayed (FY 78); complete in FY 84 Highest one-time costs ($287M) Poorest skill retention Very severe community impact	High investment and overhead costs Skill retention Severe community impact	Fresh start difficult; large resident population; 3% recruitment No long range firing of arty Moderately large community impact
	Common to all: High turbulence Large separations (RIF)		

Figure III-19

complete consolidation of effort with only the Chemical Systems Laboratory and the Aberdeen ranges and wind tunnels separated geographically. The advantages in the short term for building an ADC on an existing large development base are handicaps in the long term; the large inherited population with its established identity and way of doing business coupled with a recruitment level of only three percent seriously handicaps an effort at a "fresh start". The lack of onsite long distance ranges for both the ballistics and weapon systems laboratories is also a disadvantage for a long term single-site ADC.

2. Two-Site Alternatives. a. Alternative 4/5 (6400 and 7500 models). (ADC HQ, Small Caliber, Ballistics, and Chemical Systems Laboratories at APG; Large Caliber Laboratory at Picatinny.) This alternative takes advantage of the explosives, munitions, and fuze skills and the facilities at Picatinny. It also takes advantage of the BRL base in establishing the Small Caliber Laboratory and provides for continued good coupling between these laboratories. It should provide for very good interfaces with external agencies, and a partial "fresh start" with creation of a new systems development activity at Aberdeen where the work now is primarily in technology. The small caliber work will have available long distance ranges; however, other internal interfaces are less good; the weapon systems laboratories are separated, the headquarters is not located with the bulk of the development dollars, and the Systems Evaluation Office, Armament Concepts Office and Product Assurance Directorate must be divided. The separation of the technologies of fire control, fuzes, and munitions diminishes technology interchange and flexibility in use of the work force. Some flexibility is gained between the Ballistics and Small Caliber Laboratories. Headquarters would be located with three of the four laboratories together with TECOM, AMSAA, and the Human Engineering Laboratory, with whom the ADC will have close and frequent technical contracts. The near even split of the ADC population between sites permits use of the best facilities at both locations, but carries the disadvantage of no long-range firing capability with the large caliber systems at Picatinny. The alternative requires from 6 to 11 percent in recruitment and would be essentially complete in FY 80. One-time and recurring costs are the highest among the two-site alternatives because of the duplication of support effort. Economic impact is moderate.

b. Alternative 5A. (ADC Headquarters, Large and Small Caliber Laboratories at Picatinny; Ballistics and Chemical Systems Laboratories at Aberdeen.) This alternative places the ADC headquarters with the two weapon systems laboratories (5400 of the 7800 total population) at Picatinny and retains the BRL ballistics expertise at Aberdeen. From an operational standpoint, the collocation permits very good supervision of development activities, very good coupling of explosives and

propellants technology with development, and very good technology interchange within the collocated functions of fire control, fuzes, munitions, and weapons. This arrangement also provides excellent flexibility of the work force with corresponding potential economies, and an excellent capability for interfacing with external agencies. It does have the operational disadvantages of geographic separation of weapon systems development from ballistics technology, the lack of long-range firing facilities at Picatinny, and the perception of the poorest "fresh start" among the two-site alternatives in spite of 11 percent new recruitment. This alternative is the least costly two-site alternative and could be completed in FY 80. Economic impact is moderate and affects Frankford, Rock Island, and Watervliet the same as other two-site alternatives, but would reduce the impact at Picatinny from other alternatives (except 3A).

c. Alternative 5B. (ADC Headquarters, all laboratory headquarters at Aberdeen; munitions and fuze portions of Large and Small Caliber Laboratories at Picatinny.) This alternative could also be adapted to the 6400-man model. It maintains the systems orientation organizationally but not geographically; technology areas are grouped geographically with all weapons and fire control at Aberdeen (with its long range firing capability) and all munitions and fuzes at Picatinny. This alternative is more costly than Alternative 5A but slightly less costly than 5; provides for the ADC Headquarters to be collocated with all laboratory headquarters and with TECOM, AMSAA and HEL; provides flexibility of the work force since common technology areas are collocated; requires a split Product Assurance Directorate, Armament Concepts Office, and System Evaluation Office; requires 8% new recruiting; and could be completed in FY 80. The collocation of all the laboratories' headquarters with the ADC Headquarters provides an excellent interface with external agencies and a good image of a "fresh start". However, this alternative has the major disadvantages of geographic separation of "guns and bullets" in both Large and Small Caliber Laboratories. Economic impact is moderate resembling other two-site alternatives but separations are lowest.

d. The four two-site alternatives are compared on the following page with their major advantages and disadvantages, in Figure-III-20

(1) 1/ Alternative 5 is selected as one of the preferred alternatives because of its opportunity for a "fresh start" with the new small arms development activity at Aberdeen, the advantage provided by collocation with BRL, the availability of long distance ranges to a portion of the weapon development activity; the use of the best facilities at both

1/ Alternatives 4 and 5 are the same when considering advantages and disadvantages; both are organizationally and geographically identical, only their populations differ. The actual strength of this alternative, if implemented, would fall somewhere within the levels estimated from the 6400 man model (Alternative 4) and the 7500 man model (Alternative 5).

ADC ELEMENT	ALTERNATIVE 5		ALTERNATIVE 5A		ALTERNATIVE 5B	
	APG	PA	APG	PA	APG	PA
HEADQUARTERS	X			X	X	
SMALL CALIBER	X			X	X (-)	X (MUNITIONS)
LARGE CALIBER		X		X	X (-)	X (MUNITIONS)
BALLISTICS	X		X		X	
CHEMICAL	X		X		X	
ADVANTAGES	HQ WITH 3 LABS GOOD TECHNOLOGY INTERCHANGE -- BRL AND SMALL CALIBER LABS PARTIAL FRESH START; NEW DEVELOPMENT ACTIVITY APG; 6-11% NEW HIRES LONG-RANGE FIRING WITH SMALL CALIBER LABS		HQ WITH BULK OF DEVELOPMENT ACTIVITY - 70% of ADC LOWEST COST EXCELLENT WORKFORCE FLEXIBILITY VERY GOOD TECHNOLOGY INTERCHANGE -- FIRE CONTROL, FUZES, MUNITIONS, AND WEAPONS EFFICIENCIES OF SINGLE SEO, ACO, AND PAD 11% NEW HIRES		HQ WITH ALL LAB TOP MANAGEMENT VERY GOOD WORKFORCE FLEXIBILITY GOOD TECHNOLOGY INTERCHANGE -- FIRE CONTROL, FUZES, MUNITIONS, AND WEAPONS PARTIAL "FRESH START;" NEW DEVELOPMENT ACTIVITY APG; 8% NEW HIRES LONG-RANGE FIRING WITH WEAPON LABS	
COMMON TO ALL: BEST FACILITIES AT APG AND PA.						
DISADVANTAGES	HQ REMOVED FROM HALF OF ACTIVITY DIMINISHED WORKFORCE FLEXIBILITY DIMINISHED TECHNOLOGY INTERCHANGE BETWEEN SMALL AND LARGE CALIBER LABS INEFFICIENCIES OF DIVIDED SEO, ACO, AND PAD NO LONG-RANGE FIRING WITH LARGE CALIBER LABS		POTENTIALLY POOR TECHNOLOGY COUPLING WITH BRL DIFFICULT "FRESH START;" LARGE RESIDENT POPULATION PA NO LONG-RANGE FIRING WITH WEAPON LABS		SEPARATES "GUNS FROM BULLETS" IN LARGE AND SMALL CALIBER LABS INEFFICIENCIES OF DIVIDED SEO, ACO, AND PAD	
COMMON TO ALL: MODERATE COMMUNITY IMPACT.						

Figure III-20

with BRL, the availability of long distance ranges to a portion of the weapon development activity; the use of the best facilities at both Picatinny and BRL; and because it can be implemented rapidly.

(2) Alternative 5A is selected because it collocates top management and the two weapon systems development laboratories (approximately 70% of the population), provides excellent flexibility of the work force, facilitates technology interchange between the Large and Small Caliber Weapon Systems Laboratories and coupling with the explosives technology base, is the lowest cost two-site alternative, and can be implemented rapidly.

(3) Alternative 5B is not carried forward for further consideration because it is not believed the advantage of good work force flexibility and technology coupling gained by collocating the munitions and fuze work and the weapon and fire control work offsets the disadvantage of splitting work on "guns and bullets."

3. Three-Site Alternatives. These alternatives all place the Large Caliber Weapon Systems Laboratory at Picatinny and the Ballistic and Chemical Systems Laboratories at Aberdeen. The primary variation in these alternatives is the location of the Small Caliber Laboratory at Rock Island in alternative 6, and at the site proposed by Philadelphia, ("new" Frankford) in alternative 7 and "old" Frankford in alternative 8.

a. These three alternatives differ mainly in the proximity of the Small Caliber Laboratory to Aberdeen and Picatinny, and in the current small caliber base upon which that laboratory is being built -- small caliber weapons in the case of Rock Island and small caliber ammunition and fire control in the case of Frankford. The Rock Island alternative has advantages over Frankford in being slightly less costly and in being close to the ALC, but the disadvantage of being much more distant from the mass of the ADC activity at Aberdeen and Picatinny. Economic impact would be somewhat less in placing the Small Caliber Laboratory at Frankford because of the poor economic health of the Philadelphia area relative to that of the Rock Island Communities.

b. The three-site alternatives do have somewhat higher retention of current skills, fewer separations, and correspondingly less economic impact on communities than two-site alternatives but they least well fulfill the objectives for the ADC of all the alternatives considered. The three-site alternatives produce significant operational disadvantages and offer no cost advantages over the two-site alternatives. The separation of munitions, fuze, fire control, and weapon functions with the separation of Large and Small Caliber Weapons and the additional separation of both from ballistics technology complicates management, reduces the flexibility of the work force,

inhibits technology interchange, and also incurs diseconomies of three sets of support activities. Accordingly, the three-site alternatives will not be considered further for recommendation as preferred ADC alternatives.

COMPARISON OF ALTERNATIVES

CONFIGURATION	ALTERNATIVE [a] / LOCATION [b] / POPULATION [c]	OPERATIONAL CONSIDERATIONS: INTERNAL [d] INTERFACES	WORK FORCE FLEXIBILITY	EXTERNAL INTERFACES	"FRESH START"	STEADY STATE DATE (FY)	PERSONNEL ASPECTS: TRANSFERS (% OF ADC) IN PLACE	RELOCATE	RECRUITMENT REQUIRED (% OF ADC)	SEPARATION (RIF) EXPECTED	COSTS: ONE TIME INVESTMENT (MILLIONS)	ANNUAL STEADY STATE (MILLIONS)	PRESENT VALUE 15 YEAR OPERATIONS (BILLIONS)	[f] COMMUNITY ECONOMIC IMPACT
BASE	(1) RIA, FA, PA APG, WA 10,542	POOR	POOR	POOR			100%					$347	$2.77	
ONE-SITE (LOW POP)	(2) FT IRWIN 6,386	EXCEL	EXCEL	EXCEL	EXCEL+	1984	1392 (22%)	1722 (27%)	3,272 (51%)	1,858	$287	$272	$2.68	VERY SEVERE
	(3) APG 6,386	EXCEL+	EXCEL+	EXCEL+	EXCEL	1981	2383 (37%)	3105 (49%)	898 (14%)	1,895	$138	$281	$2.50	SEVERE
	(3A) PA 6,386	EXCEL	EXCEL	EXCEL	GOOD	1981	4597 (72%)	1624 (25%)	165 (3%)	1,620	$ 78	$275	$2.42	MODERATELY LARGE
TWO-SITE (LOW POP)	(4) APG, PA 6,948	GOOD-	GOOD	GOOD+	GOOD+	1981	4279 (62%)	2249 (32%)	420 (6%)	1,505	$ 75	$293	$2.53	MODERATE
TWO-SITE (HIGH POP)	(5) APG, PA 8,083	GOOD-	GOOD	GOOD+	GOOD+	1980	4977 (62%)	2207 (27%)	899 (11%)	1,259	$ 79	$298	$2.56	MODERATE
	(5A) APG, PA 7,817	GOOD+	EXCEL-	EXCEL-	GOOD-	1980	5571 (71%)	1374 (18%)	872 (11%)	1,349	$ 76	$287	$2.50	MODERATE
	(5B) APG, PA 7,996	FAIR+	GOOD+	EXCEL-	GOOD	1980	5158 (64%)	2207 (28%)	631 (8%)	1,191	$ 79	$296	$2.55	MODERATE
THREE-SITE (HIGH POP)	(6) APG, PA, RIA 8,291	FAIR	FAIR	FAIR +	FAIR	1980	5375 (65%)	2378 (29%)	538 (6%)	1,045	$ 87	$297	$2.56	MODERATE
	(7) APG, PA, NEW FA 8,291	FAIR	FAIR	FAIR	FAIR+	1980	5419 (65%)	2322 (28%)	550 (7%)	1,051	$ 74	$302	$2.58	SLIGHT
	(8) APG, PA, OLD FA 8,291	FAIR	FAIR	FAIR	FAIR	1980	5419 (65%)	2322 (28%)	550 (7%)	1,051	$ 72	$302	$2.58	SLIGHT

a/ Alternatives are defined in Figure II-4

b/ Edgewood Arsenal CB activity becomes the Chemical Systems Laboratory and remains in place at APG in all alternatives. BRL wind tunnels and ranges are also left in place.

c/ Any alternative could be built on the 6,400 or 7,500 man model; for economic analysis purposes, alternative 1 through 4 were built on 6,400 and 5 through 8 on 7,500 models.

d/ Internal interfaces - judges combined effects of location of ADC HQ and span of control, coupling technology with development, and integrated systems management.

e/ External interfaces - judges ease with which ADC can interact with ALC, user, AMC users and other Services, AMC HQ, private sector, and other AMC laboratories.

f/. Community impact summary - quantitative reflection of impact on communities is shown on the next page, Figure III-18.

Figure III-17

COMMUNITY IMPACT SUMMARY [a/]

COMMUNITY	ALTERNATIVE										
	CURRENT	2	3	3A	4	5	5A	5B	6	7	8
ROCK ISLAND	7,997	- 110	- 110	- 110	- 110	- 110	- 110	- 110	+1,789	- 110	- 110
PICATINNY	5,735	-5,735	-5,735	+ 553	-1,116	- 477	+ 974	-1157	- 477	- 213	- 213
WATERVLIET	2,801	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600	- 600
FRANKFORD	3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-3,600	-1,505	-1,505
ABERDEEN	15,148	-1,631	+3,743	-1,631	+ 600	+1,096	- 621	+1,689	- 621	- 621	- 621
FT IRWIN	-	+5,374	-	-	-	-	-	-	-	-	-

a/ Net impact on community due to ADC and ALC implementation.

Change page per Errata Sheet #2

Figure III-18

CHAPTER IV

MAJOR FINDINGS, RECOMMENDATION, AND CONCLUSIONS

CHAPTER IV

MAJOR FINDINGS, RECOMMENDATION, AND CONCLUSIONS

CHAPTER IV

MAJOR FINDINGS, RECOMMENDATION, AND CONCLUSIONS

SECTION A: Major Findings.

After study of the organization and operation of the current armament community, other development organizations, and the AMARC report, and after developing, analyzing, and costing numerous alternative concepts with the aid of in-house experts and consultants, the committee finds:

a. The armament acquisition process is in need of major improvement.

b. A consolidation of fragmented activities and reorganization into systems laboratories will assist in providing an opportunity for improvement, and a climate for change.

c. Significant economies can be achieved with reorganization and consolidation.

d. The armament development activities will be in a good position for the long term if any one of the preferred alternatives is adopted.

e. None of the alternatives is without disadvantages.

f. All alternatives are significantly better than the status quo.

SECTION B: Recommended Concept and Preferred Alternatives.

1. Recommended Concept. The recommended concept is to establish an Armament Development Center (ADC) responsible for research and development and the transition of newly developed armament materiel into quantity production. The ADC will be built upon a core of four laboratories, three systems development laboratories--large caliber weapons, small caliber weapons, and chemical materiel--supported by a fourth laboratory for ballistics research. The center will incorporate those on-going activities clearly relevant to the armament acquisition mission now located at Frankford, Rock Island, Picatinny, and Watervliet Arsenals, the Ballistic Research Laboratories, and Edgewood Arsenal. The organizational and operational concept follows from the objectives established for the ADC, with emphasis on those related to systems orientation, clear assignment of responsibility, intensive management of concepts and projects, close coupling between technology and development, and a strong bond with the user.

2. Preferred Alternatives. Eleven alternatives were generated by varying the population, degree of consolidation, and location of organizational elements; these have been analyzed and evaluated with respect to operational considerations, personnel, costs, and community impact. The committee has weighed the advantages and disadvantages of each alternative and finds three that stand above the rest; they are, in order of preference, as shown in Figure IV-1. An evaluation of these alternatives is presented in summary form in Figure IV-2 at the end of this section.

3. Rationale for Order of Preference. Alternative 3, with its great long term benefits, was ranked third because of the high degree of dislocation of the large caliber ammunition personnel with attendant increased potential for reduced capability, especially in support of production; the sharper adverse impact on one community (Dover); and the higher initial investment required. The initial investment of $138 million is not, by itself, considered a major discriminator since present value costs are comparable to the first choice alternative. Alternative 5 was preferred to Alternative 3 because it avoids the dislocations cited above, yet provides an excellent opportunity for a partial fresh start. Alternative 5A was preferred to Alternative 5 because the ADC headquarters would be collocated with the two principal weapon systems laboratories which constitute 70 percent of the ADC population, because of its relative ease of implementation, and because top management is located where it can directly influence generation of a "fresh start."

RANKING	ALTERNATIVE
First	Alternative 5A, Aberdeen-Picatinny, Two-Site ADC.
	Picatinny - ADC Headquarters Large Caliber Weapon Systems Laboratory Small Caliber Weapon Systems Laboratory Aberdeen - Ballistics Research Laboratory Chemical Systems Laboratory
Second	Alternative 5, Aberdeen-Picatinny, Two-Site ADC.
	Aberdeen - ADC Headquarters Small Caliber Weapon Systems Laboratory Ballistics Research Laboratory Chemical Systems Laboratory Picatinny - Large Caliber Weapon Systems Laboratory
Third	Alternative 3, Aberdeen One-Site.
	Aberdeen - ADC Headquarters Large Caliber Weapon Systems Laboratory Small Caliber Weapon Systems Laboratory Ballistics Research Laboratory Chemical Systems Laboratory

Figure IV-1

4. Impact Upon ARMCOM. A separate substudy examined the impact that the formation of an ADC would have on the remainder of ARMCOM. An Armament Logistics Command (ALC) complementary to the ADC was explored in concept form. The substudy determined that a separate Logistics Command is feasible, would not grow in population or budget from the status quo, and varies only slightly from one ADC alternative to another. Therefore, it should not influence the choice of an alternative for the ADC.

5. Implementation. The implementation plan described below is applicable to either Alternative 5A or 5, but will require some modification if Alternative 3 is selected.

a. Personnel Considerations. Expertise within the armament community's work force is a valuable national asset which must be retained and which, therefore, must be treated with care. When the decision is made to establish an Armament Development Center, affected employees and their families should be advised as soon as practicable. Their views should be solicited so that the full impact on their personal lives is known and considered during the implementation phase. This information should be used to update that obtained during the study and used in evolving and evaluating the alternative courses of action.

RANKING			FIRST	SECOND	THIRD
ALTERNATIVE LOCATION POPULATION			5A APG-PA 7,817	5 APG-PA 8,083	3 APG 6,386
OPERATIONAL CONSIDERATIONS[a/]	INTERNAL INTERFACES		GOOD +	GOOD -	EXCELLENT +
	WORKFORCE FLEXIBILITY		EXCELLENT -	GOOD	EXCELLENT +
	EXTERNAL INTERFACES		EXCELLENT -	GOOD +	EXCELLENT +
	"FRESH START"		GOOD -	GOOD +	EXCELLENT
	STEADY STATE DATE (FY)		1980	1980	1981
PERSONNEL ASPECTS[b/]	TRANSFERS (% OF ADC)	IN PLACE	5,571 (71%)	4,977 (62%)	2,383 (37%)
		RELOCATE	1,374 (18%)	2,207 (27%)	3,105 (49%)
	RECRUITMENT REQUIRED (% OF ADC)		872 (11%)	899 (11%)	898 (14%)
	SEPARATION (RIF) EXPECTED		1,349	1,259	1,895
COSTS[c/]	ONE TIME INVESTMENT (MILLIONS)		$ 76	$ 79	$138
	ANNUAL STEADY STATE (MILLIONS)		$287	$298	$281
	PRESENT VALUE 15 YEAR OPERATIONS (BILLIONS)		$ 2.50	$ 2.56	$ 2.50
COMMUNITY ECONOMIC IMPACT[d/]			MODERATE	MODERATE	MODERATE

a/ For details, see Chapter III, Section C.

b/ For details, see Chapter III, Section B.

c/ For details, see Chapter III, Section A.

d/ For details, see Chapter III, Section D.

Figure IV-2

(1) Assistance Program. Every effort should be made to provide assistance to employees relocating to the ADC, transferring to other government agencies, or leaving government service.

(a) Personnel at Watervliet, Rock Island, Frankford, Picatinny, and Aberdeen with transfer rights should be encouraged to accept employment with the ADC.

(b) "People" teams should be formed at losing and gaining installations to assist individuals moving and to keep personnel informed.

(c) A sponsorship program, possibly involving the Chamber of Commerce at the gaining location, should be encouraged to supplement these actions and help ease the difficulties of relocating.

(2) Incentives. In order to attract key personnel to the ADC, various incentive programs may be needed. These could be in the form of grade increases for which they qualify and/or other forms of remuneration such as mortgage assistance programs.

(3) Talent search and recruitment.

(a) Where it would be advantageous and within the framework of the Civil Service regulations, use of a commercial source should be considered for the conduct of a talent search to find candidates for key positions that may be difficult to fill.

(b) The Civilian Personnel Office should form implementation teams working under ADC control but located at or working closely with both gaining and losing installations.

(c) Some special travel funds should be made available for interviewees to expedite the selection and hiring of potential candidates for key ADC positions.

(d) Term appointments should be used wherever they would be advantageous. If necessary, they will be used to hire personnel to complete projects at Benet Laboratories, Rodman Laboratories, and Frankford Arsenal. They will also be used when appropriate for projects at the new ADC.

b. Operations.

(1) General. Before the ADC assumes responsibility for ongoing or new programs, key leaders must be selected, hired, and assigned duties; plans for the complex task of transition must be prepared in detail; and responsibilities, authority, and resources

assigned the implementers. The plan must be in sufficient detail so that each individual is aware of his role, that of others, and how all involved interact. Responsibilities must also be clearly assigned. Detail is needed so that the plan can be modified during the execution phase to accommodate to those events unforeseen or to those anticipated in all aspects, except timing. The ADC must be ready to accelerate the rate of implementation; movement will be determined by the availability of personnel and facilities and by the need to maintain continuity of programs. For the planning period it is proposed to establish a provisional headquarters. More information on implementation strategies and the movement of activities is contained in Annex IV-A.

(2) Provisional Headquarters. In its provisional status, the ADC will comprise a command and management element, a planning staff including experts in civilian personnel, construction, programming, transportation, and operations at each of the affected facilities, plus an administrative element.

(a) Priority will be given to the search for and selection of the laboratory directors and other top management personnel.

(b) Success may require exceptions to regulations and policies; success will require careful attention to planning the move of individuals and facilities. The constant recognition that it is "people" who accomplish the development mission must be emphasized to preclude any appearance of a false dichotomy between personnel considerations and mission accomplishment. The harmony between the two must be generated early in the life of the Provisional Headquarters and continue throughout the life of the ADC.

(c) Provisional status should be guaranteed until the major tasks are completed.

c. ADC Activation and Transition. At activation the ADC would manage the armament RD&E program as does a project manager. Until transfer, the work would be accomplished where it is being done now, at the arsenals and BRL. The ADC would provide guidance and control funds, thus, permitting it to build a new organization without being responsible for the old. By controlling all programs, the ADC can control the timing of the move of each. In general, projects in the late stages of full-scale development will be completed in place; those in earlier stages will move at program milestones or sooner, if they can be accepted. Project teams will assist in phasing old projects into the ADC. Research and exploratory development work will be moved as capabilities permit. Priority will be as follows:

(1) Establishment of systems management of large and small caliber programs.

(2) Movement of fire control, small arms ammunition, mechanical time fuzes, shell metal parts, and supporting technology work from Frankford Arsenal to meet its closure schedule.

(3) Movement of development projects with their teams from Rodman and Benet Laboratories and the ARMCOM RD&E Directorate.

(4) Movement of technology programs from Rodman Laboratories.

(5) Movement of technology programs from Benet Laboratories.

As a control measure, a technical "phase-down" team will be established at each losing activity to insure continuity of programs and to warn of potential loss of expertise and capability.

d. Time to "Steady State." It is estimated that four years will be required from date of activation of the ADC until all personnel and programs are transferred, new talent recruited, and all essential construction and renovation of facilities completed.

e. Selection of commander.

(1) The commanders selected for the ADC and ALC should be officers who have the full confidence of their superiors in AMC and DA and, therefore, can be delegated the needed authority to accomplish this large, complex, and important task.

(2) It is not possible to anticipate and resolve in advance every problem that may arise between the two commands in the orderly separation of development and logistics functions. It is only possible to acknowledge that some difficult decisions will have to be made promptly as the separation progresses and then establish the procedures for making them.

(3) Given the proper conditions and orientation, the bulk of the problems could be resolved on a cooperative basis; where interests genuinely conflict, AMC would decide the issue. If, in the judgment of the AMC Commander, this required the ready availability of an arbitrator not associated with either the ADC or the ALC, one could be designated. This could become a duty of the Deputy Commander or be assigned full time to a general officer with his own small, ad hoc staff.

f. Special Authorities. Successful creation of an ADC will require waivers to existing regulations and policies. These must

be granted, for example, to permit the ADC to have its own Civilian Personnel Office or to have assigned the number and quality of military officers needed to meet the ADC's new objectives. Special consideration should be given to reducing to the absolute minimum any normal or special reports to higher headquarters during the transition period.

g. Milestone Schedule. Figure IV-3 is the milestone schedule of the ADC covering the period from announcement of the decision to implement through the transition period.

ADC MILESTONE SCHEDULE

	MILESTONE	DATE
D-Day	Announce ADC Concept and decision to implement. Establish Provisional ADC Headquarters with top management and planning staff to include civilian personnel, movement, technical, and other supporting specialist administrative elements.	1 Jul 1975
D+1 mo	Establish task forces to accomplish detailed planning for activation of ADC and building up its capabilities. Initiate talent search for key leaders. Plan for new construction and renovation programs. Establish Civilian Personnel Office and nucleus of Procurement Office. Continuously coordinate with Logistics Command.	1 Aug 1975
D+4 mo	Submit MCA budget.	1 Nov 1975
D+6 mo	Select laboratory directors and start recruiting second level management. Establish teams at losing and gaining sites to assist in relocation of individuals, programs, and equipment.	1 Jan 1976
A-Day (D+9 mo)	Activate ADC. Assume budget authority and full responsibility for RDE programs. Assume control of development PMs. Start movement of fire control, small arms ammunition, mechanical time fuzes, shell metal parts, and supporting technologies from Frankford. Start movement of relatively new developmental programs from Rodman and Benet Laboratories.	1 Apr 1976
A+12 mo	Complete movement from Frankford and new programs from Benet and Rodman.	1 Apr 1977
A+18 mo	Establish Armament Institute.	1 Oct 1977
A+24 mo	Complete all systems management movement to ADC. Start technology program move from Benet.	1 Apr 1978
A+48 mo	Consolidate all activities at ADC. Initial MCA complete. ADC reaches "steady state" condition.	1 Apr 1980

Figure IV-3

SECTION C: Conclusions.

1. The need for improvement in the acquisition process is compelling and the study committee recommends adoption of one of three preferred alternatives with confidence that any one can provide the desired improvement.

2. The decision to implement should be made with recognition of the following:

a. The risks and costs, as well as the advantages, attendant to the selected alternative.

b. The need for skillful and flexible implementation to retain the people--professional, subprofessional, support, and administrative personnel--who comprise the expertise in the current community, thereby maintaining continuity in important programs and the capability to produce armaments.

c. The need at the start for strong support from top levels in DA and DoD, and the Congress, and for their commitment to continued support throughout the transition.

ABBREVIATIONS AND ACRONYMS

-A-

AA	Anti aircraft Artillery
AAP	Army Ammunition Plant
A/C	Aircraft
ACO	Armament Concept Office
ACR	Ammunition Condition Report
ADC	Armament Development Center
ADPE	Automatic Data Processing Equipment
AEC	US Atomic Energy Commission
AIF	Army Industrial Fund
ALC	Armament Logistics Command
ALT	Administrative Lead Time
AMARC	Army Materiel Acquisition Review Committee
AMC	US Army Materiel Command
AMCPM-PBM	AMC Project Manager - Production Base Modernization
AMDF	Army Master Data File
AMETA	Army Management Engineering Training Agency
AMMRC	Army Mechanics Materiel Research Center
AMSAA	Army Materiel Systems Analysis Activity
APDS-T	Armor Piercing Discarding Sabot - Tracer
APERS-T	Anti personnel-Tracer
APG	Aberdeen Proving Ground
ARMCOM	US Army Armament Command

ASO	Armament Systems Office
ASF	Army Stock Fund
ASPR	Armed Services Procurement Regulation
AVSCOM	US Army Aviation Systems Command

-B-

Base Mod	Munitions Production Base Modernization and Expansion
BL	Benet Laboratory, Watervliet Arsenal
BRL	Ballistic Research Laboratories, Aberdeen Proving Ground

-C-

CAD	Cartridge Actuated Device
CAMO-PAC	Central Ammunition Management Office-Pacific
CAWS	Cannon Artillery Weapon Systems
CB	Chemical and Biological
CBR	Chemical, Biological and Radiological
CCB	Configuration Control Board
CCSS	Commodity Command Standard System
CG	Commanding General
chg	Charge
CONUS	Continental United States
CP	Comptroller Directorate
CPO	Civilian Personnel Office

CSC	Civil Service Commission
CSJF	Case Study and Justification Folder
CSTA	Combat Surveillance/Target Acquisition
ctg	Cartridge

-D-

D&E	Development and Engineering Department
DA	Department of the Army
DCAS	Defense Contract Administration Services
DEMIL	Demilitarization
DLSC	Defense Logistics Services Center
DNA	Defense Nuclear Agency
DOD	Department of Defense
DPG	Dugway Proving Ground
DSA	Defense Supply Agency
DX	Direct Exchange

-E-

EA	Edgewood Arsenal
ECOM	United States Army Electronics Command
EIR	Equipment Improvement Recommendation
ENG DIR	Engineering Directorate
EOD	Explosive Ordnance Disposal

-F-

FA	Frankford Arsenal

FC . . . . . Fire Control

FL . . . . . Feltman Laboratory, Picatinny Arsenal

FMT. . . . . Field Maintenance Technician

FORSCOM . . . . . US Army Forces Command

FYDP . . . . . Five Year Defense Program

-G-

GFM . . . . . Government Furnished Materiel

GOCO . . . . . Government-owned, Contractor-operated

GOGO . . . . . Government-owned, Government-operated

GSA . . . . . General Services Administration

-H-

HDL . . . . . Harry Diamond Laboratories

HE . . . . . High Explosive

HF . . . . . Human Factors

HEAT . . . . . High Explosive Antitank

HEI . . . . . High Explosive Incendiary

HEIT-SD . . . . . High Explosive Incendiary Tractor - Self-destructing

HEP-T . . . . . High Explosive Plastic - Tracer

-I-

ICM . . . . . Improved Conventional Munitions

ILS . . . . . Integrated Logistic Support

IPCE . . . . . Independent Parametric Cost Estimate

IPR . . . . . In-process Review

-J-

JAAB . . . . . Joliet Army Ammunition Plant

JCAP . . . . . Joint Conventional Ammunition Production

JPG . . . . . Jefferson Proving Ground

-L-

LAO . . . . . Logistics Assistance Officer

LIF . . . . . Logistics Intelligence File

LO . . . . . Liaison Officer

LSAAP . . . . . Lone Star Army Ammunition Plant

-M-

MACI . . . . . Military Adaptation of Commercial Items

MCA . . . . . Military Construction, Army

MERDC . . . . . Mobility Equipment Research & Development Command

MICOM . . . . . US Army Missile Command

MIDA . . . . . Major Item Data Agency

mm . . . . . Millimeter

MM . . . . . Materiel Management

MM&T . . . . . Manufacturing Methods and Technology

MOD & EXP . . . . . Modernization and Expansion

MOS . . . . . Military Occupation Specialty Code

MTSQ . . . . . Mechanical Time, Super-Quick

MUCOM . . . . . US Army Munitions Command

NICP . . . . . National Inventory Control Point

NMP . . . . . National Maintenance Point

NOL/WO . . . . . Naval Ordnance Laboratory, White Oak

NORS . . . . . Not Operationally Ready, Supply

NSN . . . . . National Stock Number

NUC . . . . . Nuclear

NV . . . . . Night Vision

NVL . . . . . Night Vision Laboratory

NWL . . . . . Naval Weapons Laboratory

-O-

OC&S . . . . . Ordnance Center & School

OMA . . . . . Operations and Maintenance, Army

OR . . . . . Operational Reliability

OSD . . . . . Office of the Secretary of Defense

O/T . . . . . Overtime

OTEA . . . . . Operational Test and Evaluation Agency

-P-

PA . . . . . Picatinny Arsenal

PAD . . . . . Product Assurance Directorate

PAD . . . . . Propellant Actuated Device

PBA . . . . . Pine Bluff Arsenal

PBS . . . . . Plum Brook Station

PEMA . . . . . Procurement of Equipment & Missiles, Army

PM . . . . . Project Manager

PMDR . . . . . Provisioning Master Data Record

PO . . . . . Plans Office

POM . . . . . Program Objectives Memoranda

P&P . . . . . Procurement and Production Directorate

PRA . . . . . Personnel Requesting Authority

proj . . . . . Projectile

prop charge . . . . Propelling Charge

prox . . . . . Proximity

-Q-

QA . . . . . Quality Assurance

-R-

RAM . . . . . Reliability, Availability, and Maintainability

R&D . . . . . Research and Development

RD&E . . . . . Research, Development and Engineering

RDTE . . . . . Research, Development, Test and Evaluation

REFLEX . . . . . Resource Flexibility Program

RIA . . . . . Rock Island Arsenal

RIF . . . . . Reduction in Force

RL . . . . . Rodman Laboratory, Rock Island Arsenal

RMA . . . . . Rocky Mountain Arsenal

ROC . . . . . Required Operational Capability

RPE . . . . . Range Probable Error

-S-

S&T . . . . . Science & Technology Laboratories

SA . . . . . Selected Ammunition

SAF . . . . . Safeguard Munitions

SAAS . . . . . Standard Army Ammunition System

SEO . . . . . Systems Evaluation Office

SF . . . . . Safety Office

SIMO . . . . . Special Items Management Office

SP . . . . . Self-propelled

SPEF . . . . . Single Program Element Funding

SSR . . . . . Space Status Report

-T-

TACOM . . . . . US Army Tank-Automotive Command

TAGO . . . . . The Adjutant General's Office

TAMMS . . . . . The Army Maintenance Management System

TRL . . . . . Terminal Ballistics Laboratory

TDA . . . . . Tables of Distribution and Allowance

TDP . . . . . Technical data package

TDY . . . . . Temporary duty

TE . . . . . Technical Escort

TECOM . . . . . US Army Test and Evaluation Command

TMDE . . . . . Test, measurement and diagnostic equipment

TOAMAC . . . . . The Optimum Army Materiel Command

TOE . . . . . Table of Organization and Equipment

TPDS-T . . . . . Target Practice Discarding Sabot-Tracer

TP-T	Target Practice - Tracer
TRADOC	US Army Training and Doctrine Command
TROSCOM	US Army Troop Support Command
TS	Technical Support

-U-

USSASA	US Army Small Arms Systems Agency

-V-

VECP	Value Engineering Change Proposal
VRFWS	Vehicle Rapid Fire Weapon System

-W-

WADC	Washington Area Development Center
WECOM	US Army Weapons Command
WP	White Phosphorous
WP-T	White Phosphorous - Tracer
WA	Watervliet Arsenal

-Y-

YPG	Yuma Proving Ground

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE *(and Subtitle)* Final Report AMC Committee - Armament Armament Development Center Concept Plan Volume 2 of 4 Volumes	5. TYPE OF REPORT & PERIOD COVERED Study Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) AMC Committee - Armament	8. CONTRACT OR GRANT NUMBER(s) N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS Headquarters, US Army Materiel Command 5001 Eisenhower Avenue, Alexandria, VA 22333	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS N/A
11. CONTROLLING OFFICE NAME AND ADDRESS Director of Plans and Analysis (AMCPA) Headquarters, US Army Materiel Command 5001 Eisenhower Avenue, Alexandria, VA	12. REPORT DATE December 1974 13. NUMBER OF PAGES 218, incls covers
14. MONITORING AGENCY NAME & ADDRESS*(if different from Controlling Office)* N/A	15. SECURITY CLASS. *(of this report)* Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A

16. DISTRIBUTION STATEMENT *(of this Report)*

Approved for Public Release
Distribution unlimited

17. DISTRIBUTION STATEMENT *(of the abstract entered in Block 20, if different from Report)*

Same

18. SUPPLEMENTARY NOTES

N/A

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Armament Development Center
Army Materiel Acquisition Review Committee (AMARC)
US Army Armament Command (ARMCOM)

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This four-volume study responds to a DA requirement to study the recommendations of the Army Materiel Acquisition Review Committee (AMARC) regarding establishment of an Armament Development Center. The study concludes that such an organization should be created and proposes several feasible options. These are conceptual in nature; they are not detailed plans. Included is a substudy examining in concept the impact on the remainder of the Army's armament community.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

N/A

SECURITY CLASSIFICATION OF THIS PAGE *(When Data Entered)*